An LCD Touch Screen with an
Integrated BASIC & Ladder Logic Controller

CUTOUCH
CT1820

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Introduction

The CT1820 is the latest, next generation CUTOUCH improving upon the previously released CT1721C. It is comprised of a built-in CB400 Cubloc core module, a GHB3224 graphical LCD and touch panel, and includes a wide variety of I/O capabilities.

The following shows the how the CT1820 compares to the CT1721C.

1. The LCD is the same.
2. The program memory has been increased: 80KB → 200KB
3. The data memory has been reduced: 28KB → 7KB
4. FRAM non-volatile memory has been added: 32KB
5. The number of communication ports have been increased: 1 to 3
6. I/O can be extended with Comfile Technology's MODPORT (Field I/O)
7. The enclosure is rated waterproof IP65.

	CT1721C	CT1820
Program Memory	80KB	200KB
Data Memory	28KB	7KB
FRAM (Non-volatile Memory)	None	32KB
Communication Ports	1	3
Total I/O Count	82	50
MODPORT Connectivity	Not Supported	Supported

CT1721C Backward Compatibility

CT2721C code is not portable to the CT1820.

Table of Contents

Chapter 1
Overview

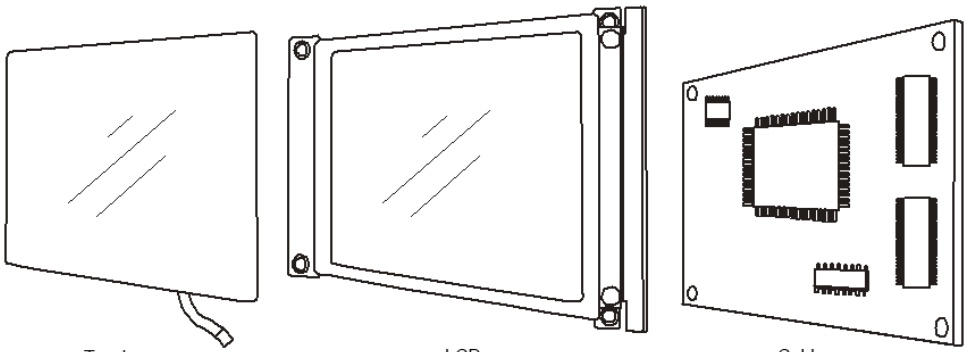
Product Comparison

	CT1721C	**CT1820 (New in 2013)**
LCD Screen	5.7" Monochrome	5.7" Monochrome
Graphics Engine	GHB3224C	GHB3224C
Core Module	CB290	CB400
Program Memory	80KB	200KB
Data Memory	28KB	7KB
Inputs	32 (24VDC)	22 (24VDC)
Outputs	32 (NPN TR)	20 (NPN TR)
Analog Inputs	8	8
High Speed Counter	2	None
PWM	6	3
External Interrupts	4	None
Total	82	50
Front Panel (IP65 Rating)	No	Yes
Download Cable	DSUB 9-PIN	3-PIN
Battery Backup	Yes	No (Use FRAM Instead)
RTC and RTC Battery	Built-in	Built-in

The CT1820 does not contain a backup battery for the data memory. To retain data between power cycles, please use the FRAM non-volatile memory instead.

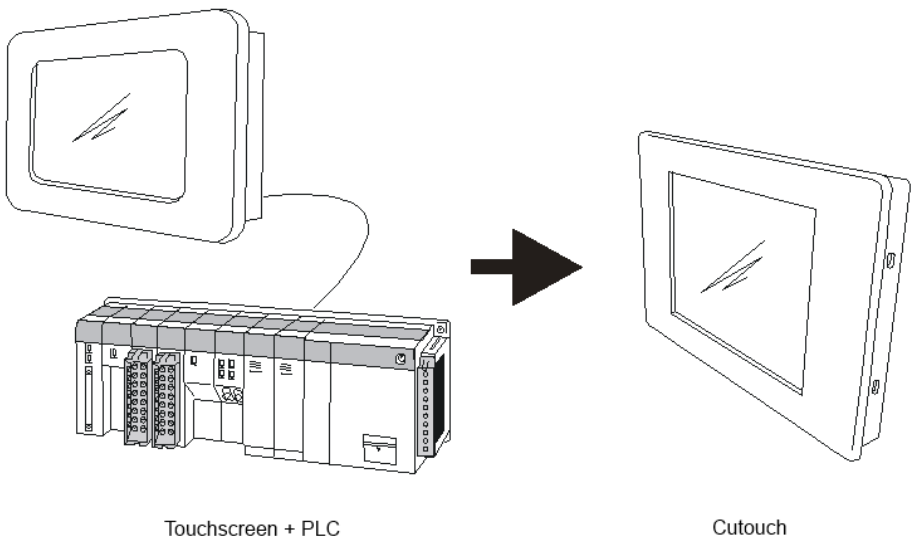
CUTOUCH Overview

The Cutouch is a Cubloc Core with an integrated LCD and Touchscreen. It can be programmed to draw graphics (lines, circle, etc...) on the LCD and to read the coordinates of touch inputs from a user.

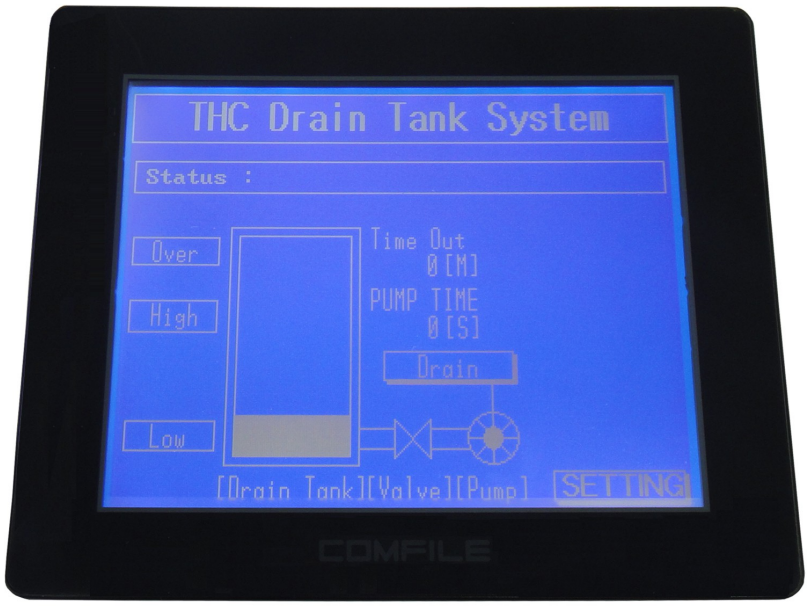


The Cutouch provides a new approach to employing a touchscreen and PLC in the automation field. The cost of a separate touchscreen, LCD, and PLC can be significant, but the Cutouch provides and integrated solution at a relatively low cost..

Futhermore, the Cutouc is programmed is BASIC, a language that is quite easy to learn and use.



The CT1820's Appearance

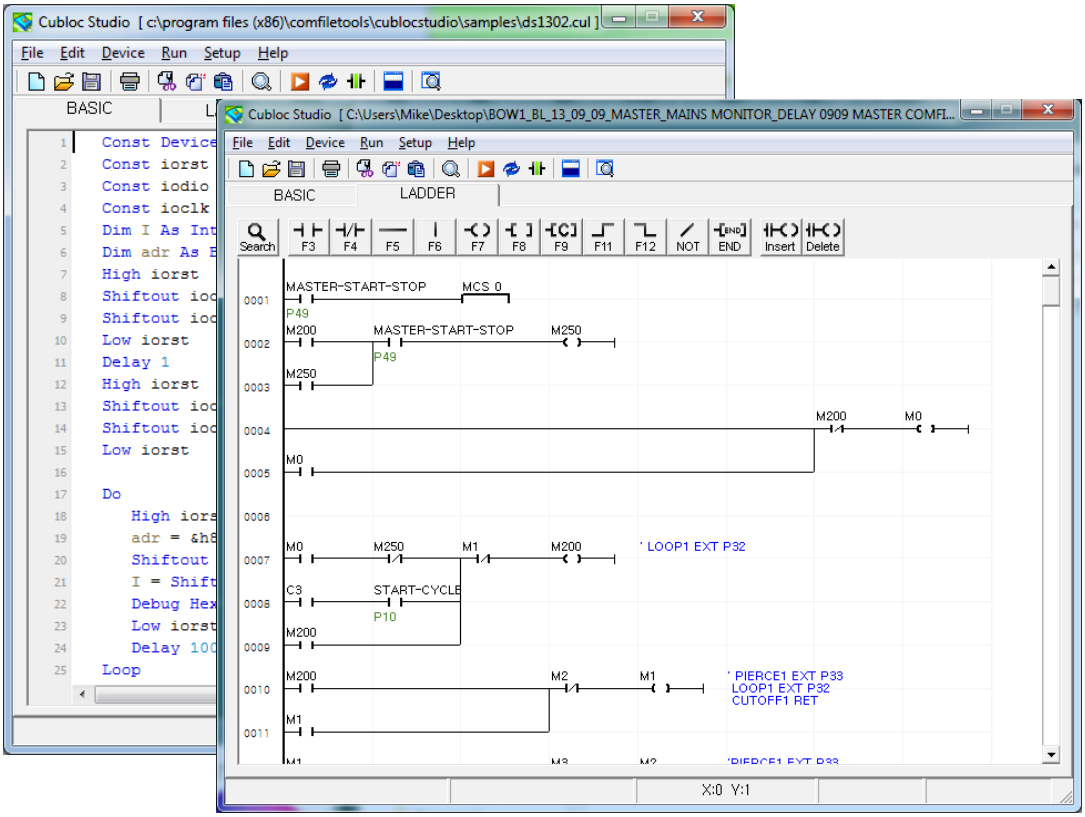



DC24V IN
DC24V IN
NPNTR OUT
NPNTR OUT
CT1820
Visual Touch Controller
COMFILE
0~20mA
ADIN
0~10VDC
ADIN


DC24V IN
DC24V IN
NPNTR OUT
NPNTR OUT
8 10 12 14 G
G 9 11 13 15
17 19 21 23
16 18 20 22 G
40 42 44 46 G
41 43 45 47 V
G 49 51 53 55 V
48 50 52 54 G
CT1820 Visual Touch Controller
COMFILE
TECHNOLOGY
0~20mA
ADIN
0~10VDC
ADIN
GND
DC24V

CUBLOC STUDIO

Cubloc Studio is the Integrated Development Environment used to program the CT1820 in both BASIC and Ladder Logic. It is a free download available from www.ComfileTech.com.



* To program the CT1820, be sure to `#include "CT18XX"` at the top of the source file.

Downloading Programs to the CT1820

After authoring and compiling source code using Cubloc Studio, it can be downloaded to the CT1820 via the host PC's RS-232 serial port for execution. Once the program is downloaded to the CT1820, it will remain in in the CT1820's read-only memory even between power cycles. First, the CT1820's download cable must be used to connect the CT1820 to the host PC.

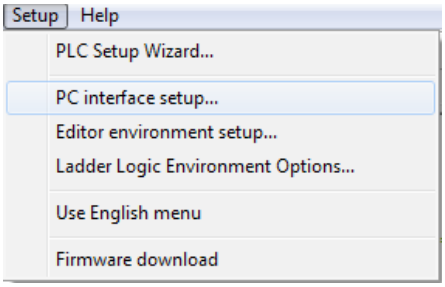
CT1820 Download Cable

CT1721C Download Cable

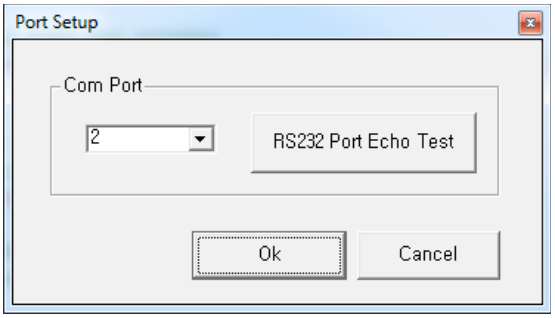
The download cable is not included as only one is needed to download to many devices. Please be sure to add a download cable to your first purchase. The host PC end of of the download cable is a DB-9 female connector and the CT1820 end is a 3-pin Molex SPOX™ 5268 female connector.

If the host PC does not have any built-in RS-232 serial ports, a USB-to-serial adapter can be used.

After the host PC is connected to the CT1820 via the download cable, open Cubloc Studio and choose "Setup" → "PC interface setup..." from the menu.

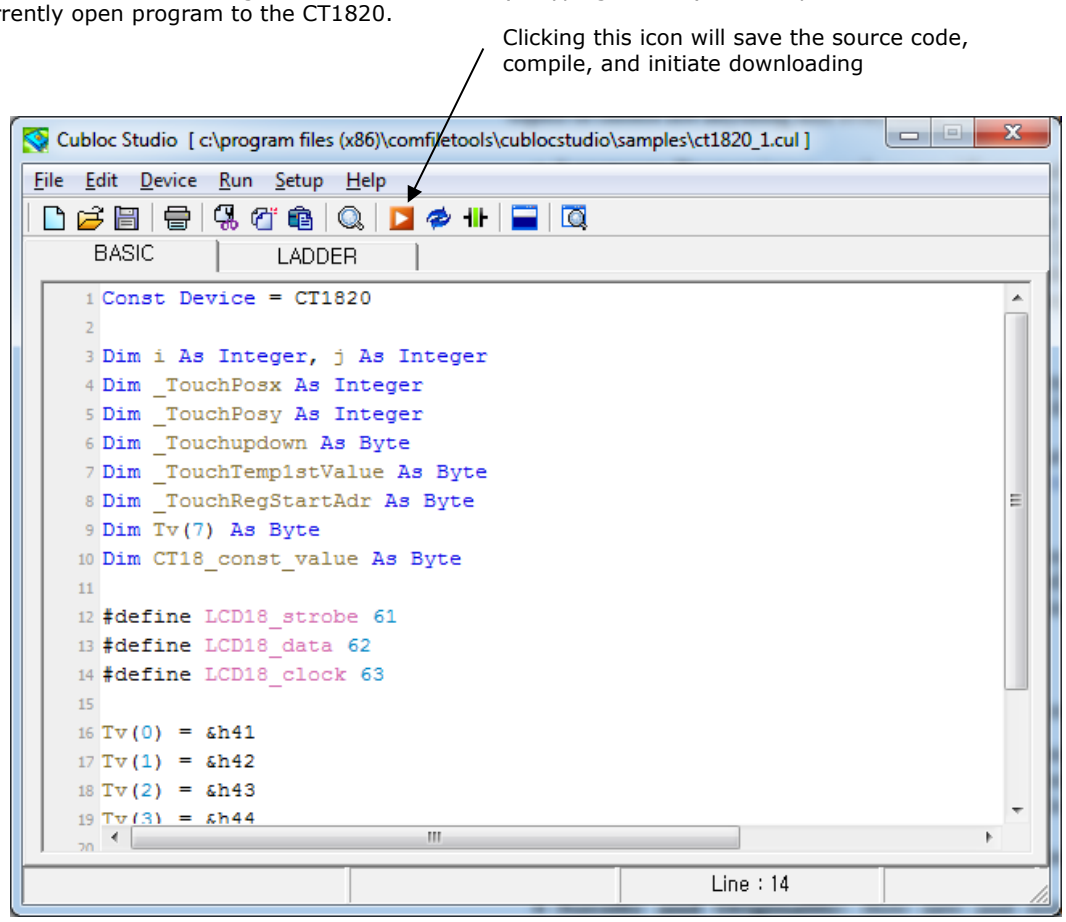


Select the host PC's serial port (Com Port) that is connected to the CT1820.



Download and Execution

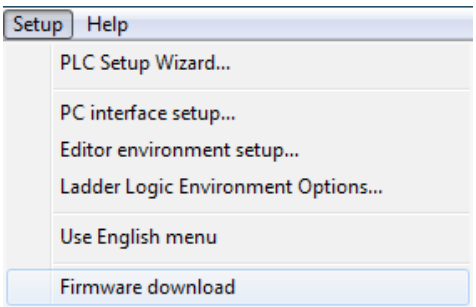
In Cubloc Studio, choosing "Run" from the menu (or typing CTRL-R) will compile and download the currently open program to the CT1820.



Once a program is compiled and downloaded to the CT1820, it cannot be retrieved and decompiled back into source code form.

Firmware Download

If downloading does not go well, it may be helpful to download the firmware.



Downloading the firmware will restore the CT1820 to its default factory state. All user programs will be lost.

The firmware is essentially the CT1820's operating system. At the time of manufacturing, the latest available firmware is downloaded to the CT1820.

If new firmware is released, a new version of Cubloc Studio will also be released. When downloading with the latest version of Cubloc Studio, a prompt may appear to update the CT1820's firmware.

CT1820 Start Pack

The CT1820 Start Pack is recommended for initial CT1820 purchases. It contains all the necessary accessories to take full advantage of the CT1820's features.

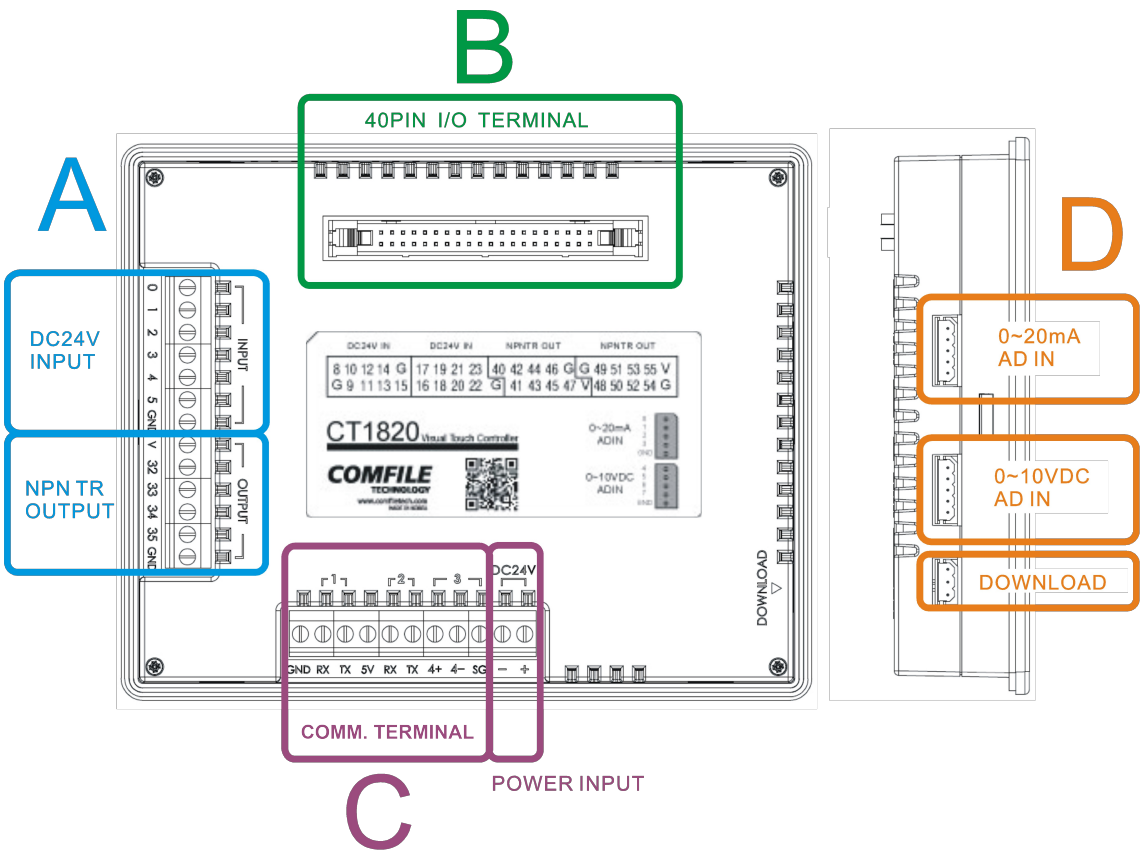
Contents: CT1820, 3-pin download cable, 1-meter 40-pin connection cable, 40-pin terminal block.

NOTE: The CT1820 Start Pack does not include a USB-to-serial adapter/cable. If your host PC does not have a built-in RS-232 serial port, you may need to buy a USB-to-serial adapter/cable separately.

Chapter 2
I/O

The CT1820's I/O Ports

The following image shows the location of the various I/O ports on the back and side of the CT1820.



Please use a 24VDC power supply (20~25VDC) and pay careful attention to the polarity.

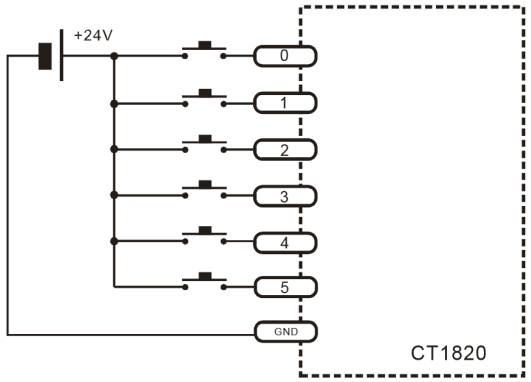
Power consumption of the CT1820 with no I/O load is approximately 3 watts.

***Please do not attempt to disassemble the the CT1820, as it can result in unintentional damage to the the LCD and other components. Products that have been tampered with will not receive warranty or service benefits.**

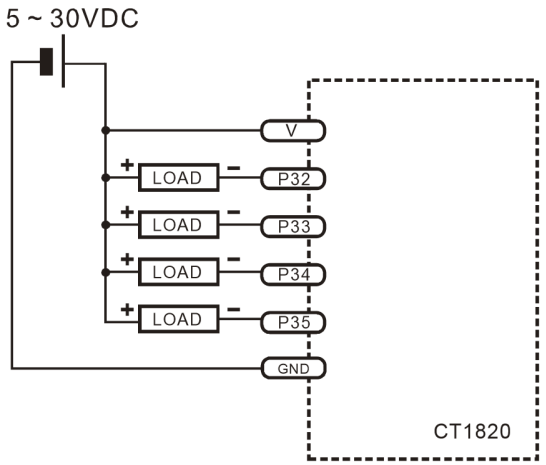
A. The Digital Input/Output ports (A) contain 6 24VDC inputs and 4 NPN transistor outputs.

Pin Number	Port Number	Input/Output	Description
0 ~ 5	0	Input	20~28VDC for active high
32 ~ 35	4	Output (Current Sink)	NPN transistor output. 'On' creates a path to ground.
V		Built-in protection diode	If the load is a relay, this must be connected to the positive terminal.

The input circuit is illustrated below.



The output circuit is illustrated below.



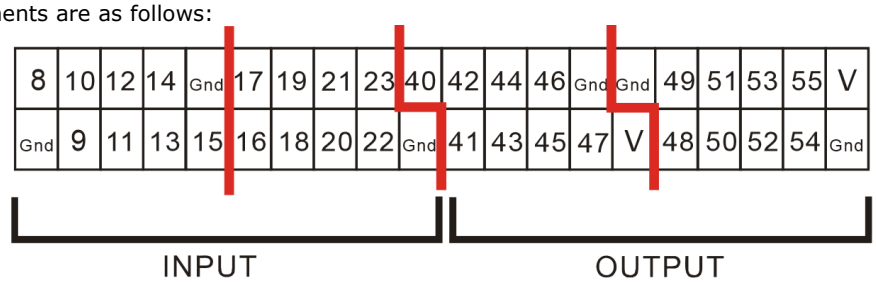
If the load is inductive, such as a relay, please be sure to connect the positive terminal to the V pin. This can help to eliminate sparking when switching.

***Warning. Please refrain from wiring while power is connected to avoid shorts and subsequent damage to the unit.**

B. This is a 40-pin terminal block connector with 16 inputs and 16 outputs, as depicted in the following image. Cables and terminal block are sold separately. The Start Pack includes a 1-meter cable, but 0.5-meter, 2-meter, and 5-meter cables are also available.

Pin Number	Port Number	Input/Output	Description
8 ~ 15	1	Input	20~28VDC for active high
16 ~ 23	2	Input	20~28VDC for active high
40 ~ 47	5	Output (Current Sink)	NPN transistor output, 'On' creates a path to ground
48 ~ 55	6	Output (Current Sink)	NPN transistor output, 'On' creates a path to ground
V		Built-in protection diode	If the load is a relay, this must be connected to the positive terminal.

Pin assignments are as follows:



The input and output configuration is described in the preceding pages.

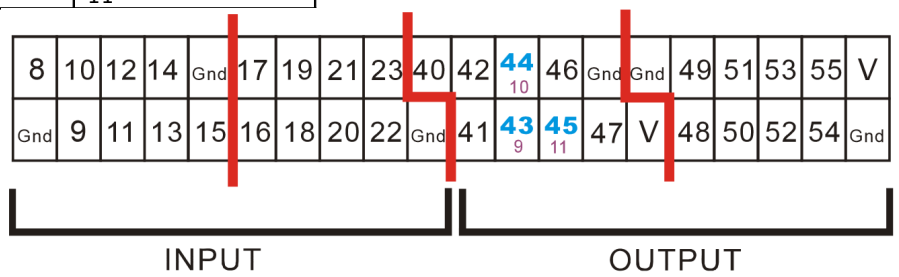
*Please do no use unassigned pins (e.g. `Low 56 'This pin is not assigned)`

***Warning. Please refrain from wiring while power is connected to avoid shorts and subsequent damage to the unit.**

PWM Output

The CT1820 has 3 PWM outputs. They are available in the 40-pin I/O port as pins 43, 44, and 45.

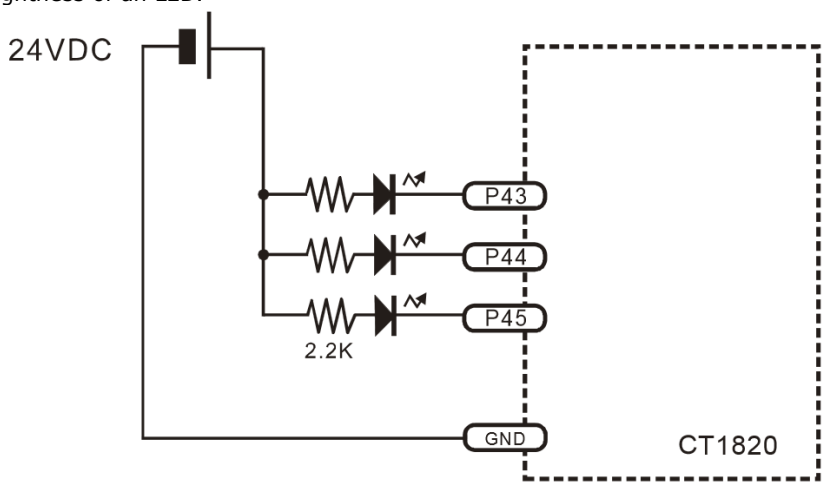
Pin Number	PWM Channel
43	9
44	10
45	11



The following program outputs pulses on channels 9, 10, and 11. The `PWMOff` command can be used to stop a PWM channel.

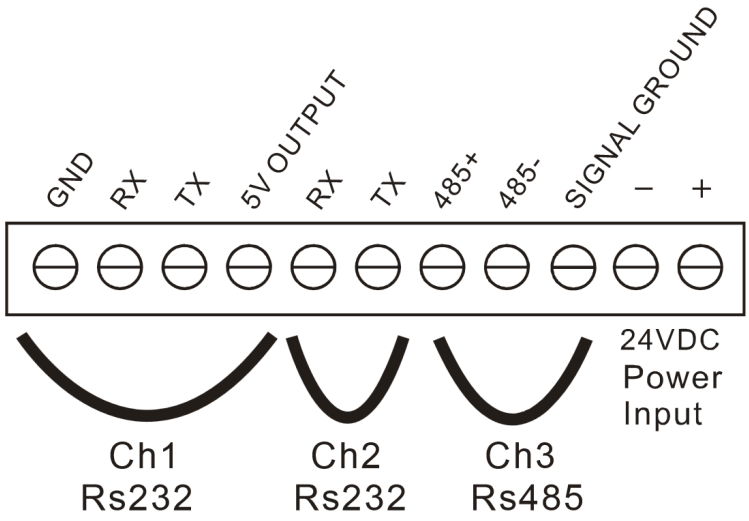
```
Low 43
Low 44
Low 45
Pwm 9,950,1024
Pwm 10,750,1024
Pwm 11,450,1024
```

The PWM output is an open-collector transistor output. It can be used in the configuration below to control the brightness of an LED.



C. This port contains the RS-232/485 communication channels and the main power supply connection.

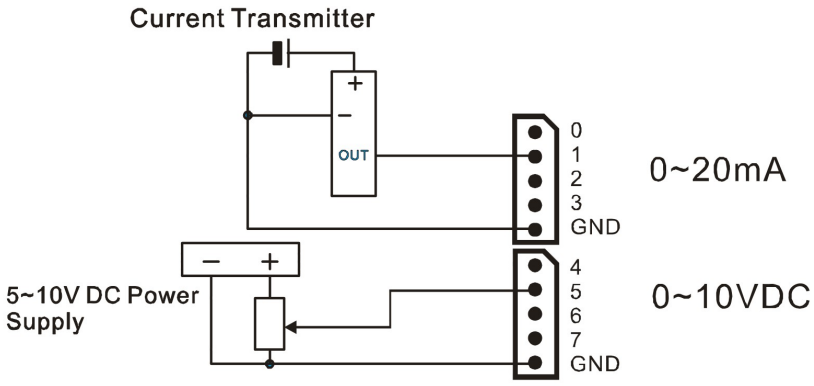
Channel	Terminals	Description
RS-232 Channel 1	RX, TX	Channel 1
RS-232 Channel 2	RX, TX	Channel 2
RS-485 Channel 3	4+, 4-, SG	Channel 3, Modport or other RS-485 connection
5V	5V	5V (0.25A) Output, generated internally by the CT1820.



D. These ports consist of the analog input ports and the download port**.**

ADC Channel Number	Input Type	Description
0 ~ 3	0 ~ 20mA	For reading current signals
4 ~ 7	0 ~ 10VDC	For reading voltage signals

Warning: Please do not exceed the specified current and voltage ranges, or the device may become damanged.



Use the download port to connect the 3-pin download cable as shown below.

CT1820's I/O Port Electrical Specifications

All input pins are 24VDC inputs only.

Input Specifications	
Input Voltage Range	20 ~ 28VDC
Recommended Operating Voltage	0 or 24VDC
Recommended Operating Current	At least 2mA
Input Impedance	2.2KΩ @ 24VDC

All output pins are NPN transistor outputs.

Output Relay Specifications	
Output Voltage Range	5 ~ 30VDC
Recommended Operating Voltage	6 ~ 27VDC
Maximum Switching Frequency	100Hz
Maximum Current	250mA / Pin
Minimum Current	10mA / Pin

High-speed counter and external interrupt features are not supported.

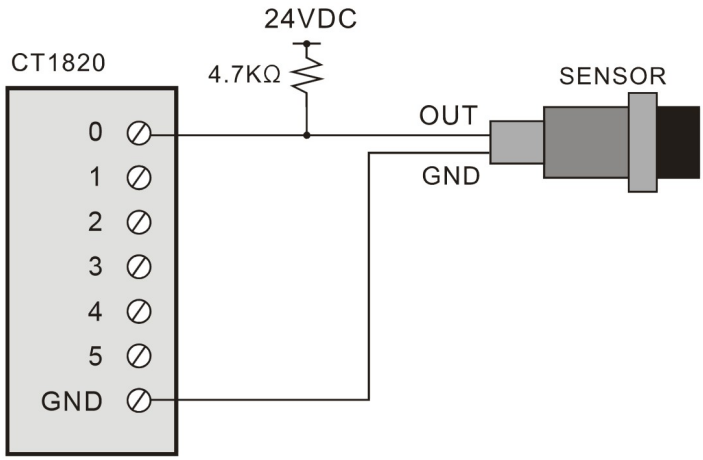
Interfacing to Proximity Sensors

Proximity sensors can be used to detect the existence, movement, and displacement of objects without any physical contact with the object. They are used quite often in the field of automation.

The following instructions show how to connect the 2-wire and 3-wire type

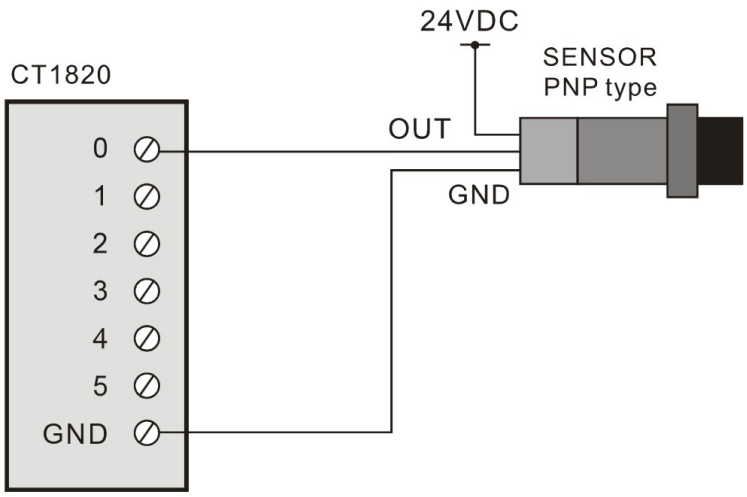
DC 2-Wire Model

Sensor output connected in reverse


24VDC
CT1820
4.7KΩ
SENSOR
OUT
GND
0
1
2
3
4
5
GND

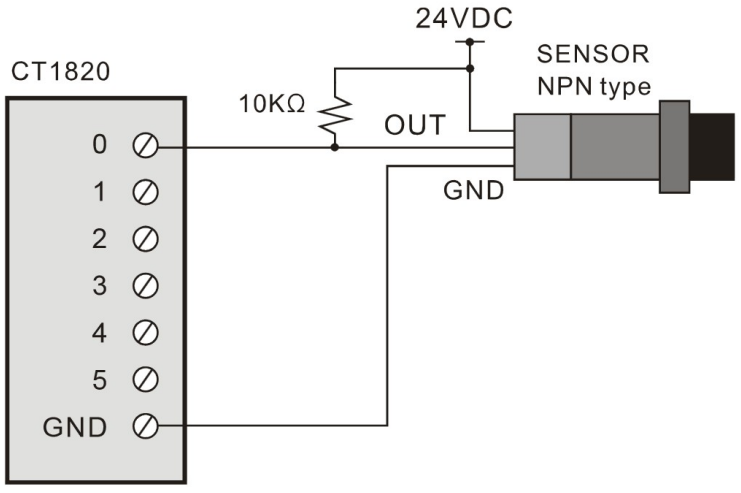
DC 3-Wire Model (PNP type)

Sensor output connected in reverse



DC 3-Wire Model (NPN type)

Sensor output connected in reverse



CT18XX Series' Relays & Registers

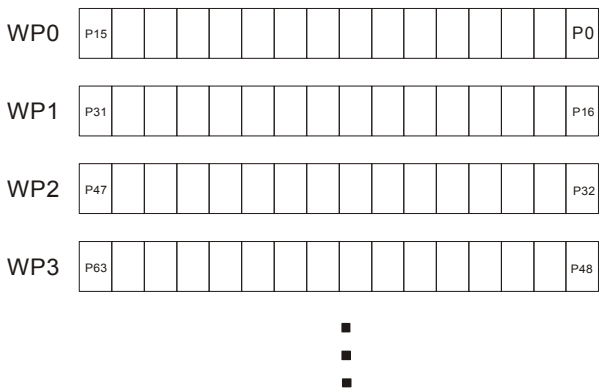
The following lists the various relays and registers available for use in Ladder Logic.

Relay/Register Designation	Range	Units	Feature
P - Input Relays	P0~P31	1 bit	For interfacing with external devices
P - Output Relays	P32~P63	1 bit	For interfacing with external devices
M - Internal Relays	M0~M511	1 bit	For saving internal status
F - Special Relays	F0~F127	1 bit	System status
T - Timer	T0~T99	16 bits (1 word)	For timers
C - Counter	C0~C49	16 bits (1 word)	For counters
D - Data Region	D0~99	16 bits (1 word)	For Data storage

P, M, and F are accessed in bit units while T, C, and D are accessed in word units. However, P, M, and F can also be accessed in word units using WP, WM, and WF respectively.

Relay/Register Designation	Range	Units	Feature
WP	WP0~7	16 bits (1 word)	For accessing P in word units
WM	WM0~WM63	16 bits (1 word)	For accessing M in word units

Lower numbered designations are stored in the lower significant bits and higher numbered designations are stored in higher significant bits. For example, the P region would appear as follows when accessed as WP.



Chapter 3
Command Reference

CT1820 Analog Input

The CT1820 has 8 analog input channels.

ADIn( )

`variable = ADIn (channel)`

`v`ariable : Variable to which the results will be stored
`c`hannel : Analog input channel (Not the I/O pin number) from which to read

Reads the value from analog input channel `c`hannel, and stores the result to `v`ariable.

The CT1820 8 10-bit analog input channels:

- Channels 0~3 are 0~20mA current analog inputs.
- Channels 4~7 are 0~10VDC voltage analog inputs.

```
A = ADIn(4)    ' Read from analog input channel 4
```

CT1820's Non-volatile FRAM

Data that needs to be retained between power cycles can be stored in the CT1820's non-volatile FRAM.

FramWrite

`FramWrite address, data`
`address` : Address to write the data to
`data` : Store 1 byte of data (variables or constants)

Stores one byte of data, `data`, to the FRAM at address, `address`.

Data can be stored from addresses 0~&H7FFF, a total of 32KB. The data will be retained between power cycles and no delay is required after a write.

```
FramWrite 14, &HFF    ' Writes &HFF to address 14
```

FramRead( )

`variable =  FramRead (address)`
`variable` : Variable to which the results will be stored
`address` : Address to read the data from

Reads one byte of data from the FRAM at address `address`, and stores the result in `variable`.

```
A = FramRead(14)    ' Reads one byte of data from address 14
```

Real-Time Clock

The CT1820 has a real-time clock (RTC) that can be used to measure calendar date and time. The `RTCWrite` command is used set the RTC's date and time, and the `RTCRead` command is used to read the RTC's current date and time.

RTCRead( )

```
Variable = RTCRead( address )
```

`v`ariable : The variable to which the result will be stored
`a`ddress : RTC's register address

The following details the format of the data retrieved from the RTC.

Address	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Feature & Range
0	0	Seconds (10^1)			Seconds (10^0)				Seconds (0~59)
1	0	Minutes (10^1)			Minutes (10^0)				Minutes (0~59)
2	0	12/24	AM/PM	Hours (10^1)	Hours (10^0)				Hours (0~23)
3	0	0	0	0	0	Day of the week			1~7 (1=Sun. ~ 7=Sat.)
4	0	0	Day (10^1)		Day (10^0)				Day (1~31)
5	Century	0	0	Month (10^1)	Month (10^0)				Month (1~12)
6	Year (10^1)				Year (10^0)				Year (0 ~ 99)

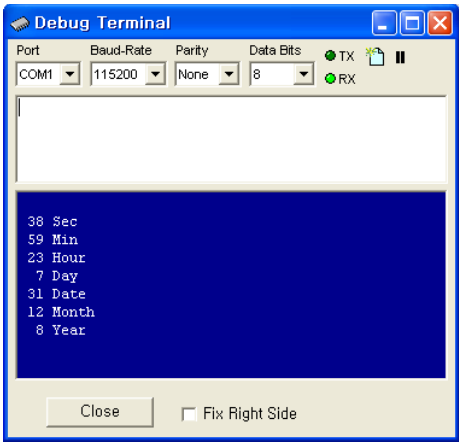
Address 0 stores the number of seconds in the RTC's current time. The data is stored as binary coded decimal (BCD), so the first 4 bits store the 10^1 digit while the lower 4 bits store the 10^0 digit

Therefore, if address 0 stores the value 0001 0001_2, then then the number of seconds is 11, not 17. Displaying the value in hexadecimal, is one way to show the value in decimal as illustrated in the example below.

```
A = RTCRead(0)
Debug Hex2 A,Cr
```

```
#include "CT18XX"
Dim i As Integer

Wait 100
RTCWrite 0,&h20       ' Sec
RTCWrite 1,&h59       ' Min
RTCWrite 2,&h23       ' Hour 24h
RTCWrite 3,&h7        ' day 1-7, 1=Sun, 2=Mon, 3=Tue, 4=Wed, 5=Thu, 6=FRI, 7=SAT
RTCWrite 4,&h31       ' Date
RTCWrite 5,&h12       ' Month
RTCWrite 6,&h08       ' Year

Do
      i = RTCRead(0)
      Debug Goxy,1,1,Hex2 i, " Sec"
      i = RTCRead(1)
      Debug Goxy,1,2,Hex2 i, " Min"
      i = RTCRead(2) And &h3f
      Debug Goxy,1,3,Hex2 i, " Hour"
      i = RTCRead(3)
      Debug Goxy,1,4,Hex2 i, " Day"
      i = RTCRead(4)
      Debug Goxy,1,5,Hex2 i, " Date"
      i = RTCRead(5)
      Debug Goxy,1,6,Hex2 i, " Month"
      i = RTCRead(6)
      Debug Goxy,1,7,Hex2 i, " Year"
      Wait 500
Loop
```

The results of this example are displayed in the Cubloc Studio debug terminal.



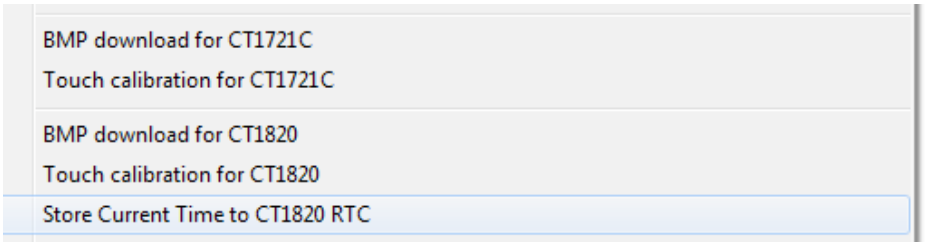
RTCWrite

`RTCWrite address, data`

`address` : RTC's register address (see table for `RTCRead`)
`data` : The data to store (variable or constant)

Stores `Data` to the RTC's register address, `Address`, effectively setting the RTC's current date and time.

The RTC's current date and time can be set from a PC within Cubloc Studio. From Cubloc Studio's menu, choose "File" → "Store Current Time to CT1820 RTC", and the PC's current date and time will be stored to the CT1820's RTC.



The CT18XX series' RTC is battery powered, so in between power cycles, the RTC's date and time continue to increment. However, the RTC is not 100% accurate, and if used for an extended period of time, a drift may become apparent, and will need to be re-synchronized with a current time source.

Beep (Sound)

The CT1820 has a built-in buzzer than can be used to generated audio feedback in the form of beeps and tones.

CT18Beep

```
CT18Beep  value
```

`value` : Integer variable or constant (less than 255).

Generates a beep. To generate an adequate feedback beep on a touch event, use a value between 20 and 50.

RS-232/485 Communication

The CT1820 has two RS-232 serial ports and one RS-485 serial port.

Note: It is recommended to not analyze the data from the serial port as it's being received because the CT1820 can process data much faster than the serial port can receive it. Rather, it would be best to leverage the CT1820's built-in Modbus RTU protocol. The Modbus RTU protocol will handle the data processing so the user doesn't have to.

OpenCom

`OpenCom channel, baudRate, settings, receiveSize, sendSize`

`channel` : The RS-232 channel to use
`baudRate` : The baud rate
`settings` : Serial settings (data bits, parity, and stop bits)
`receiveSize` : Receive buffer size (Maximum 1024 bytes)
`sendSize` : Send buffer size (Maximum 1024 bytes)

Opens a serial port for use. This command called before any data can be read from or written to the serial port.

```
Opencom 1,115200,3,80,80  ' Open Channel 1
```

By `#include "CT18XX"`, channel 3 can be used for RS-485 for communicating with RS-485 peripherals such as Comfile Technology's ModPort field I/O controller. Be sure to use `Set RS485` to set pin 71 as the transmit enable pin.

```
' Configure the serial port at the beginning of the source file
Opencom 3,57600,3,50,50
Set Rs485 3,71  ' Set Pin 71 as the transmit enable pin
```

The Set RS232 command can be used to change the serial settings

```
#include "CT18XX"
Set Rs232 3,115200,3  ' Change channel 3's serial settings
```

LCD Contrast Adjustment

The CT1820's screen contrast is adjustable through software.

CT18Contrast

`CT18Contrast  value`
`value` : Integer variable or constant (0 ~ 255)

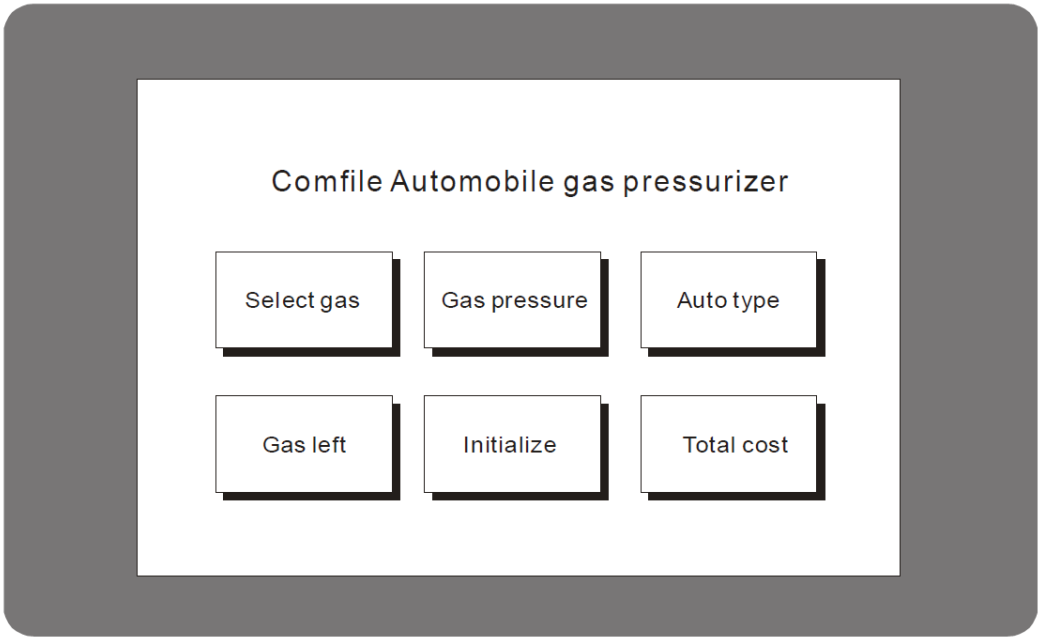
Sets the LCD's contrast. For best results, set between 130 and 160. This value is stored in the EEPROM at address &HFFF. The following program shows how this value can be read and corrected to ensure an appropriate value.

```
Dim Cont_value As Byte

Cont_value = EERead(&hfff, 1)
If Cont_value < 100 Or Cont_value > 200 Then   ' Ensure an appropriate value
      Cont_value = 150
EndIf

CT18Contrast Cont_value
```

Chapter 4
Touch Input

Menu System Library

The CT1820 includes additional commands that can be used to create and manipulate menus. With this menu library, it is easy to create a user interface like that depicted below.



Menu Commands

Up to 50 menu buttons can be created on the CT1820. Each call to the `MenuSet` command creates a new button with an individual style, location, and size. The `MenuTitle` command can be used to give the menu button a caption, and the `MenuCheck` commands can be used to determine if a button has been touched.

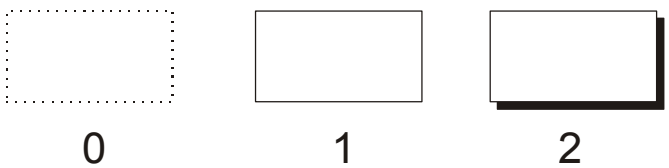
Each button's status can be changed at any time by calling the `MenuSet` command, and each button can be given a different function on a different screen, resulting in virtually an unlimited number of menus and buttons.

MenuSet

```
MenuSet  index, style, x1, y1, x2, y2
```

index : Menu index number
style : Button style (0 ~ 2)
x1, y1, x2, y2 : Menu button's screen coordinates

index value must be a number from 0 through 49. style specifies the style of the button as shown below.



x1, y1, x2, y2 are the x and y screen coordinates of the upper-left and lower-right corners of the button, respectively.

MenuReverse

```
MenuReverse index
```

index : Menu index number

This command causes the menu button identified by index to have it's colors reversed for visual feedback. This is useful to provide visual feedback to a user, indicating that a menu button has been touched.

MenuSetClear

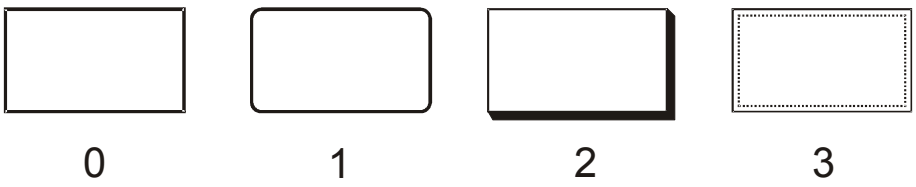
```
MenuSetClear
```

Clears all menu buttons on the screen. Call this before creating a new menu. This commands is not available in the CT1721C.

MenuSet2

`MenuSet2 index, style, x1, y1, x2, y2`
`index` : Menu index number
`style` : Button style (0 ~ 3)
`x1, y1, x2, y2` : Menu button coordinates

This command is exactly the same as the `MenuSet` command, but can draw different styles. This command is not available in the CT1712C.



MenuReverse2

`MenuReverse2 index, style`
`index` : Menu index number
`style` : Button style

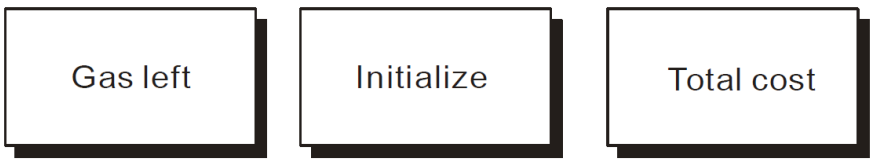
This command is exactly the same as the `MenuReverse` command, but it used for buttons declared with the `MenuSet2` command. This command is not available in the CT1712C.

MenuTitle

`MenuTitle index, x, y, string`
`index` : Menu index number
`x, y` : Coordinates of the caption from the button's top-left corner
`string` : The caption to display

`MenuSet` only draws the button itself. Use the `MenuTitle` command to set the button's caption.

```
MenuTitle 0,13,13,"Gas Left"
MenuTitle 1,16,13,"Initialize"
MenuTitle 2,13,13,"Total Cost"
```



MenuCheck( )

`variable = MenuCheck( index, touchX, touchY)`

`variable` : Variable to which the results will be stored (1 = touched, 0 = not touched)
`index` : Menu index number
`touchX` : X coordinate of touch
`touchY` : Y coordinate of touch

Use this function to determine if a menu button has been touched. `touchX` and `touchY` are the x and y coordinates of where the user touched the screen.

If the coordinates of the touch lie within the area of the button, 1 is returned, otherwise 0 is returned.

```
If Menucheck(0,TX1,TY1) = 1 Then
        Menureverse 0
        Beep 18,180
End If
```

Menu( )

`variable = Menu(index, coordinate)`

`variable` : Variable to store the results (1 = selected, 0 = unselected)
`index` : Menu index number
`coordinate` : Coordinate to check (0=x1, 1=y1, 2=x2, 3=y2)

This function can be used to inspected the coordinates of a given menu button created. `coordinate` 0 will read the x coordinate of the top-left corner (x1), 1 will read the y coordinate of the top-left corner (y1), 2 will read the x coordinate of the bottom-right corner (x2), and 3 will read the y coordinate of the bottom-right corner (y2).

```
If Menu(0,1) < 100 THEN  ' If menu button 0's top is less than 100
```

To test the CT1820 menu buttons, copy and paste the following program to Cubloc Studio.

```
#include "CT18XX"
      Dim I As Integer
      Dim TX1 As Integer, TY1 As Integer
      Contrast 550
      On Pad Gosub GETTOUCH
      Menuset2 0,3,120,155,195,200
      Menutitle 0,20,14,"RESET"

      Do
             Locate 15,6
             Print DEC5 I
             Incr I
             Delay 200
      Loop

GETTOUCH:
      TX1 = Sys(10)
      TY1 = Sys(11)
      Locate 0,0
      Print Dec TX1, "  ", Dec TY1

      If Menucheck(0,TX1,TY1) = 1 Then
             Menureverse2 0,3     ' Notice the '2' at the end of this command
             Ct18beep 20          ' Audio feedback
             I = 0
      End If
      Return
```

Processing Touch Input

The method for processing touch input on the CT1820 is slightly different from that of the CT1721C.

The following program shows how to determine when and where a touch event occurs and process it.

```
      '
      ' Demo for Cutouch
      '
      #include "CT18XX"
      Dim TX1 As Integer, TY1 As Integer
      On Pad Gosub TouchInput       ' ← (1) Attach Interrupt Service Routine
      Do
      Loop
TounchInput:
      TX1 = Sys(10)                 ' ← (2) Start of Interrupt Service Routine
      TY1 = Sys(11)
      Circlefill TX1,TY1,10         ' ← (3) Draw a point where touched
      Return
```

(1) `On Pad Gosub TouchInput` : When a touch event occurs, a routine called `TouchInput` will be called

(2) When a touch event occurs, execution will branch to this location. The X and Y coordinates of the touch can be ready using the `Sys(10)` and `Sys(11)` function calls respectively.

(3) Draw a point on the display at the location where the touch occurred.

This method is different from the CT1721C as described below.

1. **Using `Set Pad` is not necessary**
2. **The `Sys` function call is used instead of `GetPad` to read the touch coordinates.**

CT1721C

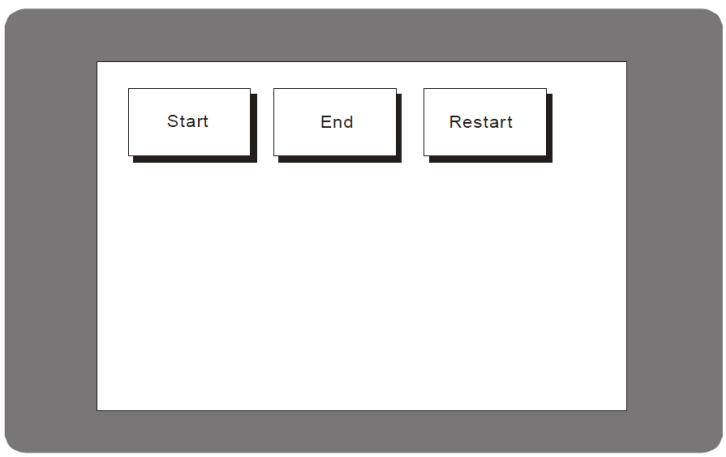
```
  Set Pad 0,4,5
  On Pad Gosub TouchInput
  Do
  Loop

TouchInput:
  Tx = Getpad(2)
  Ty = GetPad(2)
  Return
```

CT18XX

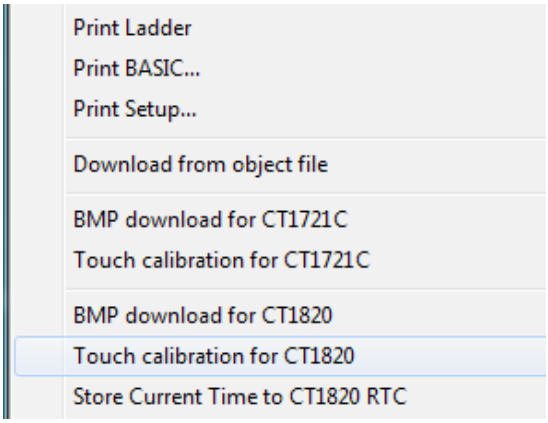
```
  On Pad Gosub TouchInput
  Do
  Loop

TouchInput:
  Tx = Sys(10)
  Ty = Sys(11)
  Return
```

The following program shows how all of the previously mentioned features can be utilized to easily create an intuitive and responsive user interface. When a button is pressed, its colors will be reversed for visual feedback, and a "beep" sound will be generated for audio feedback.

```
      '
      ' Demo for Cutouch
      '
      #include "CT18XX"
      Dim TX1 As Integer, TY1 As Integer
      Dim k As Long
      CT18contrast 150              ' Adjust this value to change the screen contrast
      On Pad Gosub TouchInput
      Menuset 0,2,8,16,87,63
      Menutitle 0,13,13,"Start"
      Menuset 1,2,96,16,176,63
      Menutitle 1,13,13,"End"
      Menuset 2,2,184,16,264,63
      Menutitle 2,13,13,"Restart"
      Low 18
      Do
      Loop
TouhcInput:
      TX1 = Sys(10)
      TY1 = Sys(11)
      Circlefill TX1,TY1,10
      If Menucheck(0,TX1,TY1) = 1 Then
            Menureverse 0
            CT18beep 20    ' Audio feedback
      End If
      If Menucheck(1,TX1,TY1) = 1 Then
            Menureverse 1
            CT18beep 20    ' Audio feedback
      End If
      If Menucheck(2,TX1,TY1) = 1 Then
            Menureverse 2
            CT18beep 20    ' Audio feedback
      End If
      Return
```

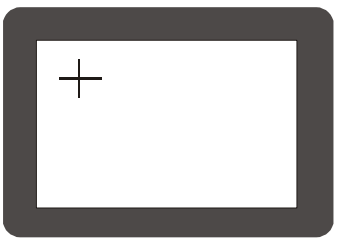


Touch Calibration



In Cubloc Studio select the "Touch calibration for CT1820" menu option from the "File" menu to download and execute a program to calibrate the touchscreen.

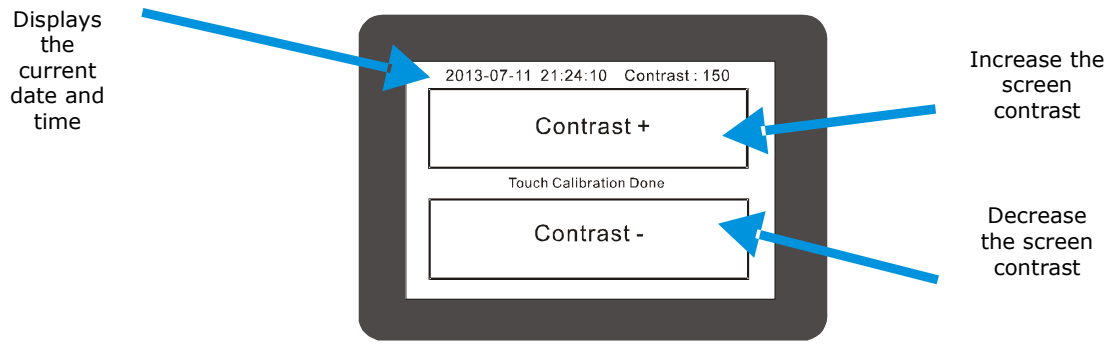
The user will be prompted to touch 4 points on the screen to complete the calibration.



The calibration settings will be stored in the CT1820's EEPROM so the calibration will be retained even if the CT1820 is powered off.

The PC's current date and time will also be synchronized with the CT1820's RTC.

After the calibration is finished, the screen contrast can be adjusted. The screen contrast values will be written to EEPROM address &HFFF and can be read at runtime if necessary.



Each CT1820 will have to have its contrast set individually. It can be set at runtime using the `CT18Contrast` command as shown below.

```
CT18Contrast 150
```

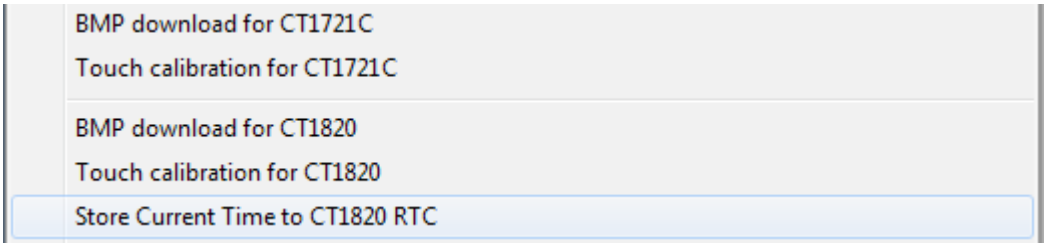
If using the "Touch calibration for the CT1820" menu option in Cubloc Studio, the contrast value can be read and assigned at runtime as shown below.

```
CT18Contrast EERead(&HFFF,1)
```

To ensure the value in the EEPROM represents a usable value use the following code to filter out any values that may be too bright or too dark.

```
Dim Cont_value As Byte
Cont_value = EERead(&hfff,1)
If Cont_value < 100 Or Cont_value > 200 Then   ' Set and appropriate value if needed
      Cont_value = 150
Endif
CT18Contrast Cont_value
```

Setting the RTC's Date and Time



In Cubloc Studio's "File" menu, there is a "Store Current Time to CT1820 RTC" menu option. This feature can be used to set the CT1820's RTC's date and time to that of the PC running Cubloc Studio.

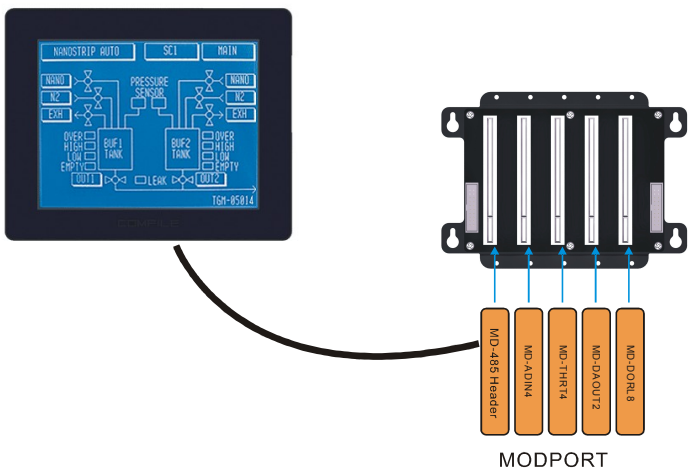
After setting the date and time, the CT1820 will execute a program that can be used to adjust the screen contrast. The screen contrast will be saved to the EEPROM at address &HFFF and can be read to set the screen contrast at runtime.

Chapter 5
ModPort I/O Expansion

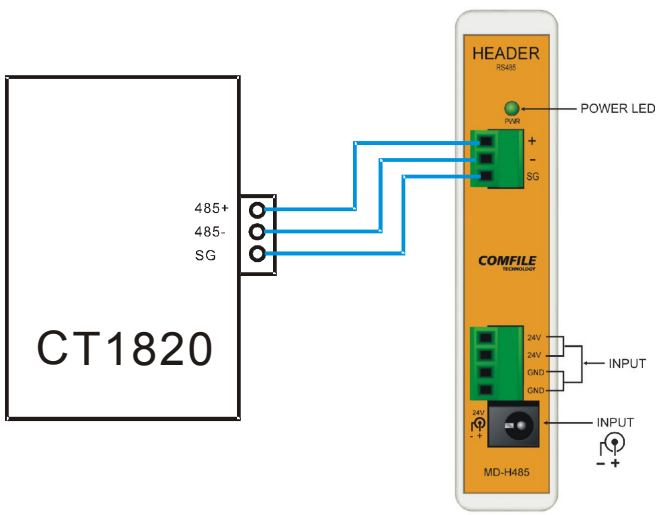
Using the CT2820 with the Modport

The Modport is a modular, RS-485, Modbus field I/O controller from Comfile Technology featuring digital input and output, analog input, temperature sensing, and a variety of other features. It can be purchased from http://www.comfiletech.com/modport.aspx.

The CT2820 can be connected to the Modport to expand its I/O capabilities. The CT1820 features a library of built-in commands to make it simple and easy to communicate with the Modport.



Please refer to the illustration below to connect the CT1820 to the Modport.



Modport Function Library

This section describes each of the CT1820's built-in Modport functions.

Each Modport module is assigned an ID. The ID is used to distinguish it from other modules of the same type. The ID can be assigned a number from 0 ~ 9. See the Modport manual for more information.

MD-DORL8 (8-pin Output Relay)

`MPRelay ID, RelayNumber, OnOff`

`ID`: The ID of the module
`RelayNumber`: Index of the individual relay (0 ~ 7)
`OnOff`: Whether to turn the relay on or off (on = 1, off = 0)

Command to turn on/off an individual relay on the MD-DORL8 output relay module.

```
MPRelay 1, 3, 1   ' Turn on module 1, relay 3
```

MD-DOSO8 (8-pin DC Source Output Module)

`MPSource ID, PinNumber, OnOff`

`ID`: The ID of the module
`PinNumber`: Index of the individual pin (0 ~ 7)
`OnOff`: Whether to turn the pin on or off (on = 1, off = 0)

Command to turn on/off a pin on the MD-DOSO8 DC source output module.

```
MPSource 1, 2, 1  ' Turn on module 1, pin 2
```

MD-DOSI8 (DC Sink Output Module)

```
MPSink  ID, PinNumber, OnOff
```

ID: The ID of the module
PinNumber: Index of the individual pin (0 ~ 7)
OnOff: Whether to turn the pin on or off (on = 1, off = 0)

Command to turn on/off a pin on the MD-DOSI8 DC sink output module.

```
MPSink 1, 2, 1  ' Turn on module 1, pin 2
```

MD-DIDC8 (8-pin DC Input Module)

```
Variable = MPIn (ID, PinNumber)
```

ID : The ID of the module
PinNumber : Index of the individual pin (0 ~ 7)

Reads the state of a pin on the MD-DIDC8 module. The value read is stored in `Variable`.

```
A = MPIn(2, 3)  ' Read pin 3 of module 2 and store the results in A
```

MD-THRT4 (4-channel Resistance Thermometer Module)

```
Variable = MPThIn (ID, Channel)
```

`ID` : The ID of the module

`Channel`: Channel selection (1 ~ 4)

Reads temperature in °C from a PT100 resistance thermometer. If the module cannot be found 9999 is returned. If the temperature exceeds the upper threshold, 5555 is returned. If the temperature is below the lower threshold, -1111 is returned.

The value must be divided by 10 to obtain the actual temperature. For example the value 254 represents a temperature of 25.4°C. Negative temperatures are indicated with a most significant bit of 1 (Note that this is not 2's complement).

Please see the MD-THRT4's documentation for more information.

```
A = MPThIn(2, 1)  ' Read temperature from module 2, channel 1 and store in A
```

MD-ADIN4 (4-Channel analog input module)

```
Variable = MPADIn (ID, Channel)
```

`ID` : The ID of the module

`Channel`: The number of the channel to read (1~4)

Reads from one of the 4 channels on the MD-ADIN4 module.

If the module cannot be found, 19999 is returned. In 1~5V mode, -11,111 is returned if voltage is less than 1V and 22,222 is returned if value is greater than 5V. Values falling within the 1~5V rage will return a value between 0 and 10,000 (13.3 bit resolution).

```
A = MPADIn(2, 3)  ' Read from module 2, channel 3 and store value in A
```

MD-HADIN4 (High-Resolution 4-Channel analog input module)

```
Variable = MPHADIn ( ID, Channel)
```

`ID`: The ID of the module

`Channel`: The number of the channel to read (1~4)

Reads from one of the 4 channels on the MD-HADIN4 module.

If the module cannot be found, 199,999 is returned. In 1~5V mode, -111,111 is returned if voltage is less than 1V and 222,222 is returned if value is greater than 5V. Values falling within the 1~5V rage will return a value between 0 and 100,000 (13.3 bit resolution).

```
A = MPHADIn(2, 3)  ' Read from module 2, channel 3 and store value in A
```

MD-DAOUT2 (Digital-to-analog voltage output module)

```
MPDAOutV  ID, Channel, OutputValue
```

`ID` : The ID of the module

`Channel` : The channel to output to (1 or 2)

`OutputValue` : Integer value representing the voltage to output (0~60000)

Outputs a voltage on one of the channels of a MD-DAOUT2 module.

```
MPDAOutV 1, 2, B  ' Outputs voltage B on module 1, channel 2
```

MD-DAOUT2B (Digital-to-analog current output module)

MPDAOutA ID, Channel, OutputValue

ID : The ID of the module

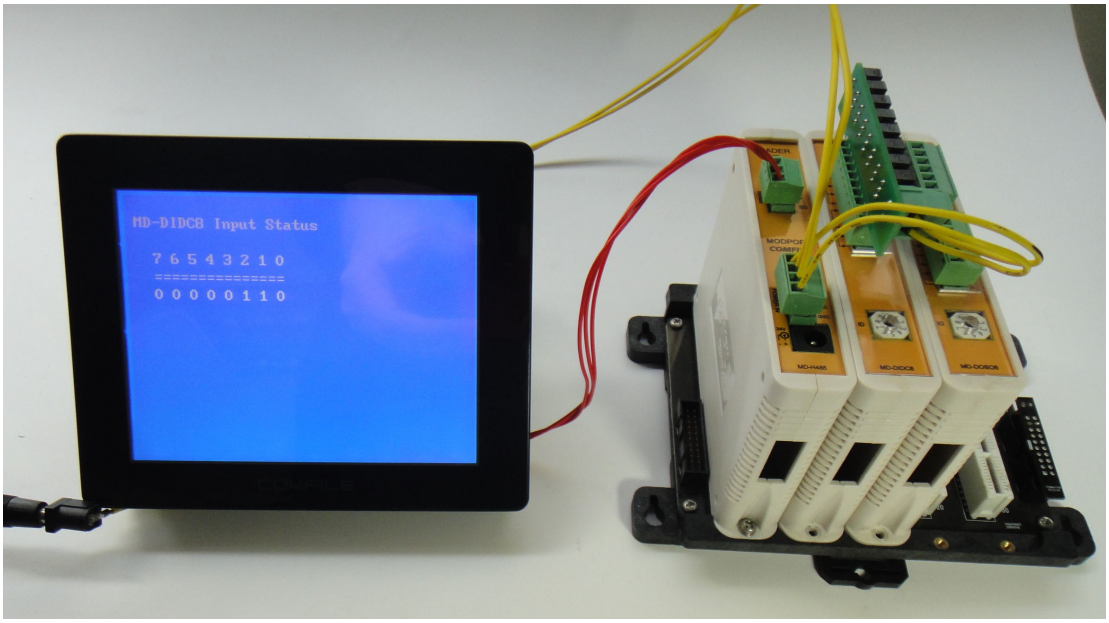
Channel : The channel to output to (1 or 2)

OutputValue : Integer value representing the current to output (0~60000)

Outputs a current on one of the channels of a MD-DAOUT2 module.

```
MPDAOutA 1, 2, B  ' Outputs current B on module 1, channel 2
```

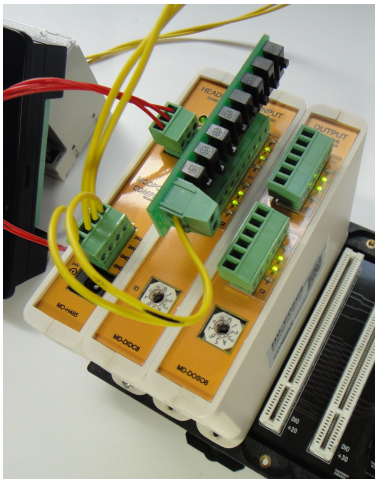
Modport Test Program



The following program reads the status of 8 inputs on the MD-DIDC8 digital module, and simultaneously outputs each status to the MD-DOS08 digital output module

```
#include "CT18XX"

Dim TX1 As Integer
Dim TY1 As Integer

On Pad Gosub TouchOccur
'
'********************* Main Do Loop ************************
'
Locate 1,1
Print "MD-DIDC8 Input Status"
Locate 3,3
Print "7 6 5 4 3 2 1 0"
Locate 3,4
Print "================"
Do
Locate 2,5
Print hex2 MPin(1,7),hex2 MPin(1,6),hex2 MPin(1,5),hex2 MPin(1,4),hex2 MPin(1,3),hex2
  MPin(1,2),hex2 MPin(1,1),hex2 MPin(1,0)
MPsource 2,0,MPin(1,0)
MPsource 2,1,MPin(1,1)
MPsource 2,2,MPin(1,2)
MPsource 2,3,MPin(1,3)
MPsource 2,4,MPin(1,4)
MPsource 2,5,MPin(1,5)
```

```
MPsource 2,6,MPin(1,6)
MPsource 2,7,MPin(1,7)
Wait 500

Loop

TouchOccur:
      TX1 = Sys(10)
      TY1 = Sys(11)
      Pset TX1,TY1
      Ct18beep 10
      Return
```



Comfile Technology's input simulator is used in this example to make it easy to toggle and test inputs. The input simulator can be purchased from http://www.comfiletech.com/inputsimulatoer.aspx.

Chapter 6
Sample Programs

Sample 1

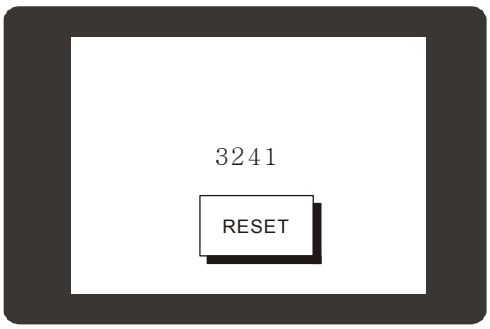
This sample program displays an ever-increasing number. This sample is included with the Cubloc Studio installation.

Simply cut and past this code into Cubloc Studio to give it a try.

```
#include "CT18XX"
Dim I As Integer
Ct18contrast 150      ' LCD contrast setting

Do
       Locate 15, 6
       Print DEC5 I
       Incr I
       Delay 200
Loop
```

Sample 2

This sample program is similar the previous sample program, but adds a "RESET" button to restart the count at 0.

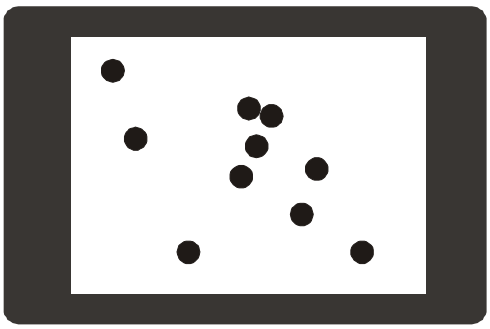



```
      #include "CT18XX"
      Dim I As Integer
      Ct18contrast 150        ' LCD contrast setting
      Dim TX1 As Integer, TY1 As Integer
      Contrast 550
      On Pad Gosub GETTOUCH
      Menuset 0,2,120,155,195,200
      Menutitle 0,20,14,"RESET"

      Do
            Locate 15,6
            Print DEC5 I
            Incr I
            Delay 200
      Loop

GETTOUCH:
      TX1 = Sys(10)
      TY1 = Sys(11)
      If Menucheck(0,TX1,TY1) = 1 Then
            CT18beep 20    ' Audio feedback
            I = 0
      End If
      Return
```

`Set Pad` is used to configure the dedicated kepad/touchpad port. `On Pad` is used to assign an interrupt service routine to jump to when a touch event occurs.

Sample 3

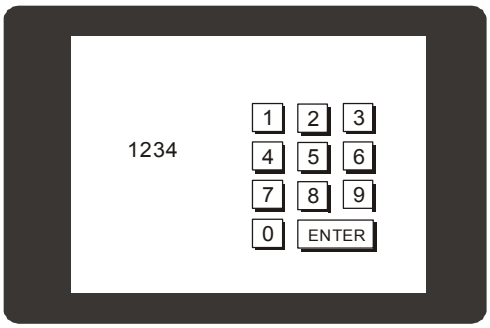
This sample draws a filled circle wherever the screen is touched.



```
      #include "CT18XX"
      Dim I As Integer
      Dim TX1 As Integer, TY1 As Integer
      Ct18contrast 150
      On Pad Gosub GETTOUCH
      Do
      Loop

GETTOUCH:
      TX1 = Sys(10)
      TY1 = Sys(11)
      Circlefill TX1,TY1,2
      CT18beep 20    ' Audio feedback
      Return
```

Sample 4: Numeric Input

This sample shows how one can implement a numeric keypad. Enter a number on the keypad, and the value entered will be displayed on the screen.




```
      #include "CT18XX"
      Dim TX1 As Integer, TY1 As Integer
      Dim I As Integer
      I=0
      Ct18contrast 150
      On Pad Gosub GETTOUCH
      Menuset 0,2,165,50,195,75
      Menutitle 0,11,4,"1"
      Menuset 1,2,205,50,235,75
      Menutitle 1,11,4,"2"
      Menuset 2,2,245,50,275,75
      Menutitle 2,11,4,"3"
      Menuset 3,2,165,85,195,110
      Menutitle 3,11,4,"4"
      Menuset 4,2,205,85,235,110
      Menutitle 4,11,4,"5"
      Menuset 5,2,245,85,275,110
      Menutitle 5,11,4,"6"
      Menuset 6,2,165,120,195,145
      Menutitle 6,11,4,"7"
      Menuset 7,2,205,120,235,145
      Menutitle 7,11,4,"8"
      Menuset 8,2,245,120,275,145
      Menutitle 8,11,4,"9"
      Menuset 9,2,165,155,195,180
      Menutitle 9,11,4,"0"
      Menuset 10,2,205,155,275,180
      Menutitle 10,17,4,"ENTER"
      I =0
      Do
      Loop

GETTOUCH:
      TX1 = Sys(10)
      TY1 = Sys(11)
      If Menucheck(0,TX1,TY1) = 1 Then
```

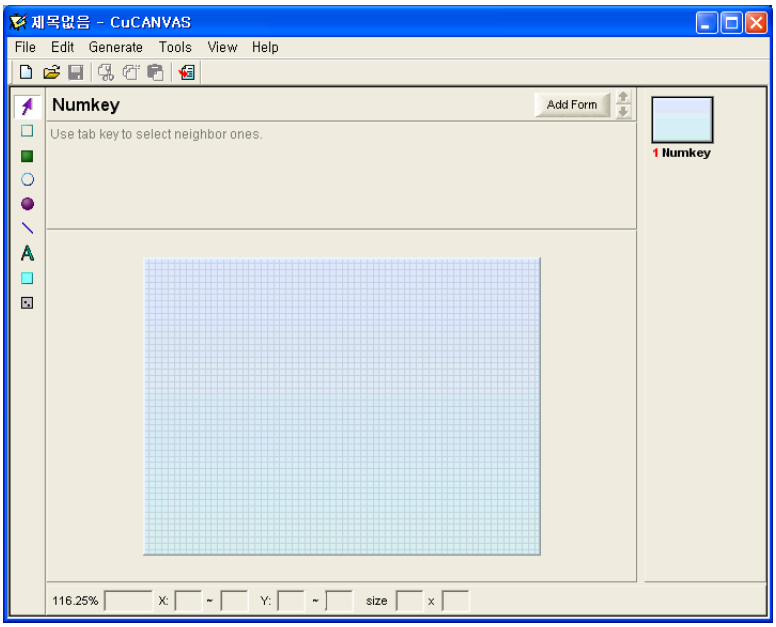
```
            I = I << 4
            I = I + 1
            CT18beep 20    ' Audio feedback
      Elseif Menucheck(1,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 2
            CT18beep 20
      Elseif Menucheck(2,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 3
            CT18beep 20
      Elseif Menucheck(3,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 4
            CT18beep 20
      Elseif Menucheck(4,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 5
            CT18beep 20
      Elseif Menucheck(5,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 6
            CT18beep 20
      Elseif Menucheck(6,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 7
            CT18beep 20
      Elseif Menucheck(7,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 8
            CT18beep 20
      Elseif Menucheck(8,TX1,TY1) = 1 Then
            I = I << 4
            I = I + 9
            CT18beep 20
      Elseif Menucheck(9,TX1,TY1) = 1 Then
            I = I << 4
            CT18beep 20
      Elseif Menucheck(10,TX1,TY1) = 1 Then
            Locate 3,5
            Print Hex4 i
            I = 0
            CT18beep 20
      End If
      Locate 3,3
      Print HEX4 I
      Return
```

The final result is stored as binary coded decimal (BCD), so the `BCD2Bin` command is used to convert the value to binary format.

Sample 5: CuCanvas

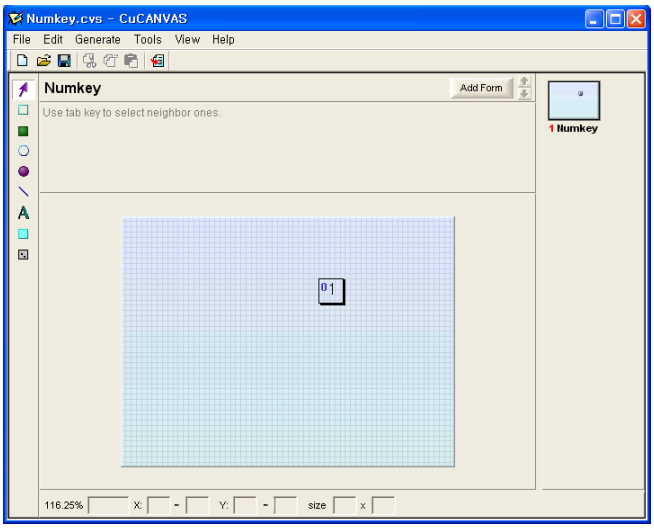
It can be quite inconvenient to compute coordinates and layout a user interface in code, so Comfile Technology created the CuCanvas WYSIWYG utility to make it easier for users to layout a user interface and generate the necessary BASIC code. CuCanvas is a free download from Comfile Technology's website.

In CuCanvas, click the "Add Form" button to create a new from called "NumKey" as shown below.

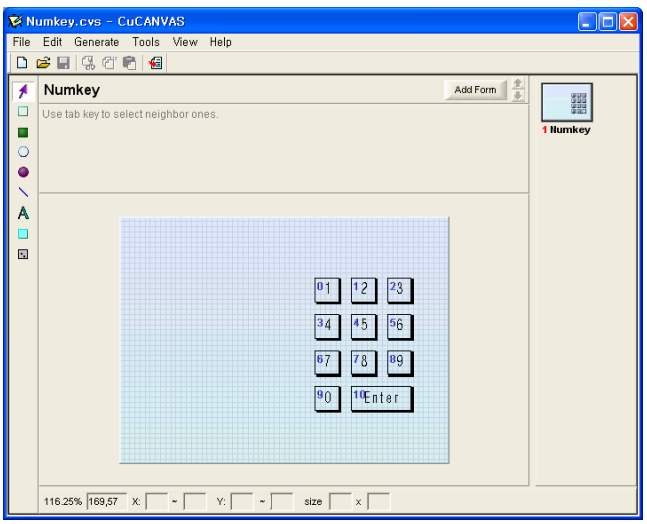


The toolbar on the left can be used to draw boxes, circles, lines, etc.. Click the "Menu for CUTOUCH" button to add a menu button. After clicking the button, draw the button on the screen.

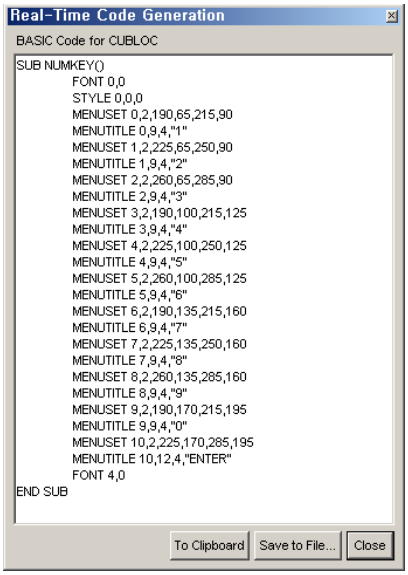
The menu button index (ID) will be displayed in the top left corner. Enter text in the "Title" textbox to change the button's caption.



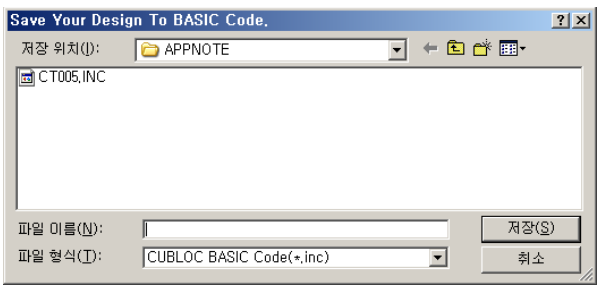
Add additional buttons to create the numpad as shown below.



Select the "View/Hide Code" button from the top toolbar to show the generated BASIC code. As shown below. Click the "To Clipboard" button to copy the code and paste it in "Cubloc Studio".



The code can also be saved as a Cubloc Studio include file by choosing the "Save to File.." button.



Include files make it easy to change the interface of a program without a lot of cut and paste operations within the main code.

The following program is exactly same as Sample 4 except an include file is used for the virtual keypad:

```
      #include "CT18XX"
      Dim TX1 As Integer, TY1 As Integer
      Dim I As Integer
      Ct18contrast 150
      On Pad Gosub GETTOUCH
      NUMKEY         ' Calls subroutine in CT005.inc to draw the user interface
      I =0
      Do
      Loop

GETTOUCH:
      TX1 = Sys(10)
      TY1 = Sys(11)
      If Menucheck(0,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 1
             CT18beep 20
      Elseif Menucheck(1,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 2
             CT18beep 20
      Elseif Menucheck(2,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 3
             CT18beep 20
      Elseif Menucheck(3,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 4
             CT18beep 20
      Elseif Menucheck(4,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 5
             CT18beep 20
      Elseif Menucheck(5,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 6
             CT18beep 20
      Elseif Menucheck(6,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 7
             CT18beep 20
      Elseif Menucheck(7,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 8
             CT18beep 20
      Elseif Menucheck(8,TX1,TY1) = 1 Then
             I = I << 4
             I = I + 9
             CT18beep 20
      Elseif Menucheck(9,TX1,TY1) = 1 Then
             I = I << 4
             CT18beep 20
      Elseif Menucheck(10,TX1,TY1) = 1 Then
             I = 0
             CT18beep 20
      End If
```

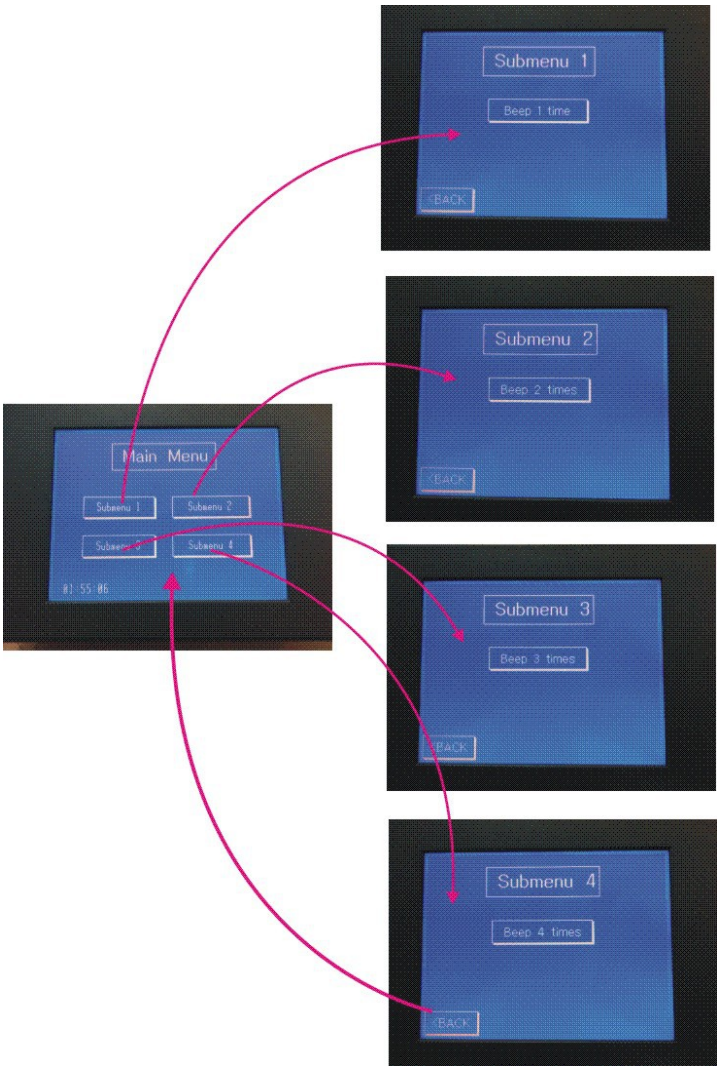
```
      Locate 3,3
      Print HEX4 I

      Return

      End

#INCLUDE "CT005.INC"
```

We must place the `#include` directive at the end of the code, as the generated code is in the form of a subroutine, which must come after the `End` statement in the main program.

Sample 6: Multi-page Menu Implementation

This sample demonstrates how to set up a paging and menu system.

Switching between screens is quite simple. Maintain a variable that keeps track which screen is currently being displayed. While switching to a new screen, always update this variable. Use the variable to determine which set of `MenuCheck` tests should be run for a particular screen. Subroutines are very useful for compartmentalizing the code.



The following code can be cut an pasted into Cubloc Studio.

```
#include "CT18XX"
Ramclear
Ct18contrast 150

On Pad Gosub ProcessTouch

Dim TX1 As Integer
Dim TY1 As Integer

Dim CurrentScreen As Byte
      #define _MAINMENU 0
      #define _SUBMENU1 1
      #define _SUBMENU2 2
      #define _SUBMENU3 3
      #define _SUBMENU4 4

MAIN
CurrentScreen = _MAINMENU

Do
      If CurrentScreen = _MAINMENU Then
            Set Onpad Off
            DisplayTime
            Set Onpad On
      Endif
      Delay 250
Loop
ProcessTouch:
      TX1 = Sys(10)
      TY1 = Sys(11)


      Select Case CurrentScreen
            Case _MAINMENU
                  ProcessMainMenu
            Case _SUBMENU1
                  ProcessSubMenu1
            Case _SUBMENU2
                  ProcessSubMenu2
            Case _SUBMENU3
                  ProcessSubMenu3
            Case _SUBMENU4
                  ProcessSubMenu4
      End Select

Return

End


Sub ProcessMainMenu()
      If Menucheck(0,TX1,TY1) = 1 Then
            FlashMenu 0
            CurrentScreen = _SUBMENU1
            Cls
            SUBMENU1

      Elseif Menucheck(1,TX1,TY1) = 1 Then
            FlashMenu 1
            CurrentScreen = _SUBMENU2
            Cls
```

```
              SUBMENU2

      Elseif Menucheck(2,TX1,TY1) = 1 Then
              FlashMenu 2
              CurrentScreen = _SUBMENU3
              Cls
              SUBMENU3

      Elseif Menucheck(3,TX1,TY1) = 1 Then
              FlashMenu 3
              CurrentScreen = _SUBMENU4
              Cls
              SUBMENU4
      Endif
End Sub

Sub ProcessSubMenu1()
      If Menucheck(0,TX1,TY1) = 1 Then
              FlashMenu 0
              Beeper 1
      Elseif Menucheck(1,TX1,TY1) = 1 Then
              FlashMenu 1
              CurrentScreen = _MAINMENU
              Cls
              MAIN
      Endif
End Sub

Sub ProcessSubMenu2()
      If Menucheck(0,TX1,TY1) = 1 Then
              FlashMenu 0
              Beeper 2
      Elseif Menucheck(1,TX1,TY1) = 1 Then
              FlashMenu 1
              CurrentScreen = _MAINMENU
              Cls
              MAIN
      Endif
End Sub

Sub ProcessSubMenu3()
      If Menucheck(0,TX1,TY1) = 1 Then
              FlashMenu 0
              Beeper 3
      Elseif Menucheck(1,TX1,TY1) = 1 Then
              FlashMenu 1
              CurrentScreen = _MAINMENU
              Cls
              MAIN
      Endif
      End Sub

Sub ProcessSubMenu4()
      If Menucheck(0,TX1,TY1) = 1 Then
              FlashMenu 0
              Beeper 4
      Elseif Menucheck(1,TX1,TY1) = 1 Then
              FlashMenu 1
              CurrentScreen = _MAINMENU
              Cls
              MAIN
      Endif
```

```
End Sub

Sub Beeper(Num As Byte)
      Dim i As Byte
      For i = 1 To Num
             CT18beep 20
             Wait 200
      Next
End Sub


Sub FlashMenu(Num As Byte)
      Menureverse Num
      Delay 150
      Menureverse Num
End Sub

Sub DisplayTime()
      Glocate 16,220
      Font 0,0
      Dprint
Dp(Bcd2bin(Rtcread(2)),2,1),":",Dp(Bcd2bin(Rtcread(1)),2,1),":",Dp(Bcd2bin(Rtcread(0)),
2,1)
End Sub

Sub MAIN()
      Font 6,1
      Style 0,0,0
      Glocate 96,24
      Gprint "Main Menu"
      Font 0,1
      Menuset 0,2,40,96,144,128
      Menutitle 0,20,8,"Submenu 1"
      Menuset 1,2,168,96,280,128
      Menutitle 1,24,8,"Submenu 2"
      Menuset 2,2,40,152,144,184
      Menutitle 2,20,8,"Submenu 3"
      Menuset 3,2,168,152,280,184
      Menutitle 3,24,8,"Submenu 4"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 80,16,232,56
      Font 4,0
End Sub

Sub SUBMENU1()
      Font 6,1
      Style 0,0,0
      Glocate 96,24
      Gprint "Submenu 1"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 80,16,232,56
      Font 2,1
      Menuset 0,2,88,88,224,120
      Menutitle 0,22,8,"Beep 1 time"
      Menuset 1,2,0,208,72,239
      Menutitle 1,10,7,"<BACK"
      Font 4,0
```

```
End Sub

Sub SUBMENU2()
      Font 6,1
      Style 0,0,0
      Glocate 96,24
      Gprint "Submenu 2"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 80,16,232,56
      Font 2,1
      Menuset 0,2,88,88,224,120
      Menutitle 0,16,8,"Beep 2 times"
      Menuset 1,2,0,208,72,239
      Menutitle 1,10,7,"<BACK"
      Font 4,0
End Sub

Sub SUBMENU3()
      Font 6,1
      Style 0,0,0
      Glocate 96,24
      Gprint "Submenu 3"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 80,16,232,56
      Font 2,1
      Menuset 0,2,88,88,224,120
      Menutitle 0,16,8,"Beep 3 times"
      Menuset 1,2,0,208,72,239
      Menutitle 1,10,7,"<BACK"
      Font 4,0
End Sub

Sub SUBMENU4()
      Font 6,1
      Style 0,0,0
      Glocate 96,24
      Gprint "Submenu 4"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 80,16,232,56
      Font 2,1
      Menuset 0,2,88,88,224,120
      Menutitle 0,16,8,"Beep 4 times"
      Menuset 1,2,0,208,72,239
      Menutitle 1,10,7,"<BACK"
      Font 4,0
End Sub
```

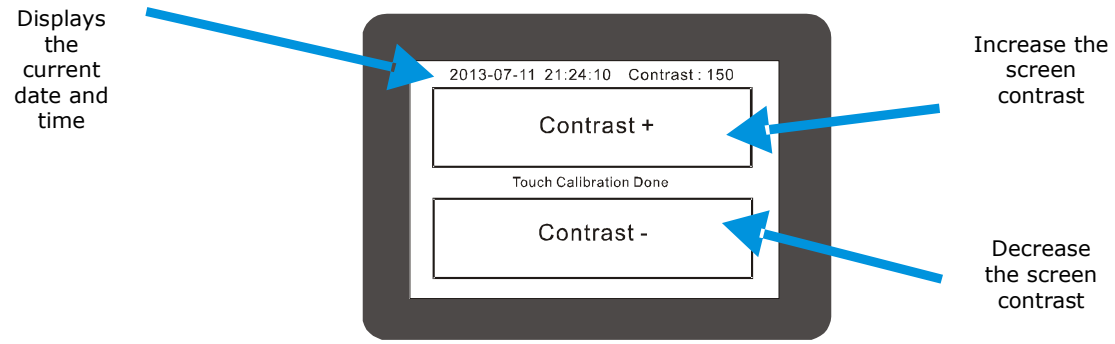
The `CurrentScreen` variable is used to keep track of the active page being displayed. This variable is checked in the touch interrupt service routine to determine which set of `MenuChecks` to perform.

Sample 7: Contrast Adjustment

This program demonstrates how to adjust the screen contrast at runtime. The screen contrast is stored in the EEPROM at addres &HFFF.

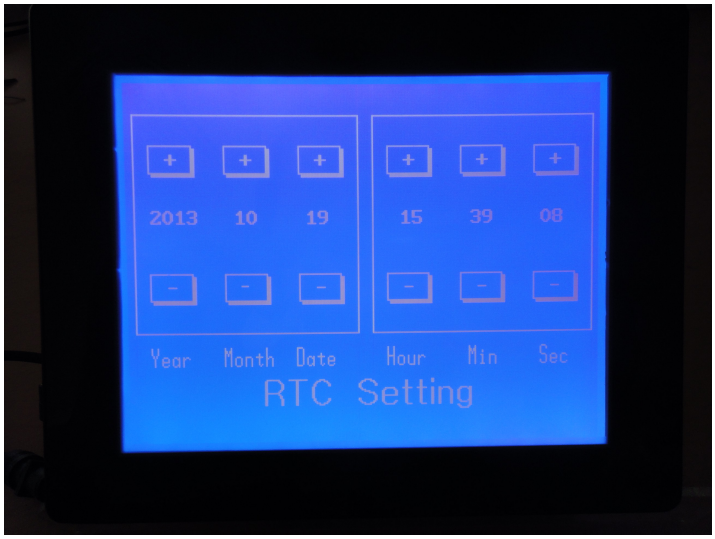
```
#include "CT18XX"

Dim CT18_cont_value As Byte

CT18_cont_value = Eeread(&hfff,1)
If CT18_cont_value = &hff Then
      CT18_cont_value = 150
Endif
Ct18contrast CT18_cont_value


Box 10,20,310,100
Box 10,140,310,230
Font 5,1
Glocate 120,50
Gprint "Contrast +"
Glocate 120,175
Gprint "Contrast -"
Ct18beep 30
Font 2,0
On Pad Gosub TouchOccur
'
' ******************** Main Loop ************************
'
Do
      Locate 0,0
      Print "20",Hp(Rtcread(6),2,1),"-",Hp(Rtcread(5),2,1),"-",Hp(Rtcread(4),2,1), "
", Hp(Rtcread(2),2,0),":",Hp(Rtcread(1),2,1),":",Hp(Rtcread(0),2,1)
      Locate 24,0
      Print "Contrast : ",Dp(CT18_cont_value,3,0)
      Wait 1000
Loop

TouchOccur:
      _TouchPosx = Sys(10)
      _TouchPosy = Sys(11)

      If _TouchPosy > 120 Then
            CT18_cont_value = CT18_cont_value - 1
            Ct18contrast CT18_cont_value
            Eewrite &hfff,CT18_cont_value,1
      Else
            CT18_cont_value = CT18_cont_value + 1
            Ct18contrast CT18_cont_value
            Eewrite &hfff,CT18_cont_value,1
      Endif
      Ct18beep 30
      Return

End
```

The date and time are displayed on the top of the screen as read from the RTC.

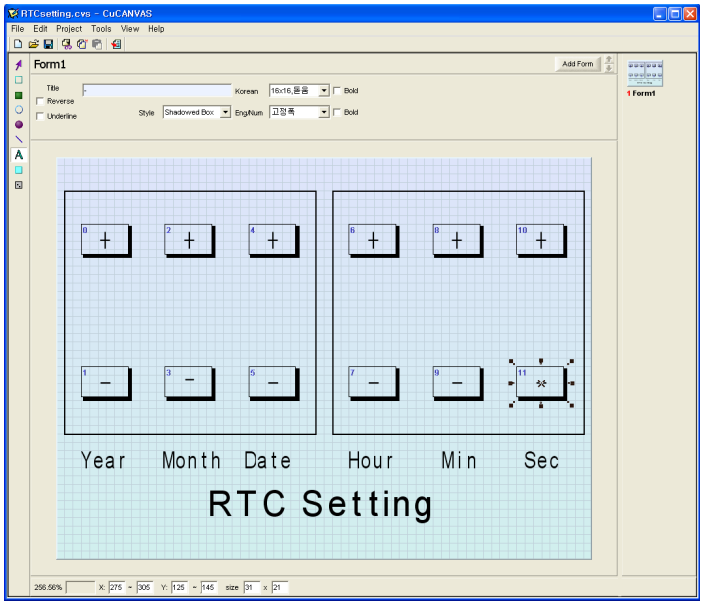


Sample 8: RTC Adjustment

This sample program can be used to adjust the RTC's date and time.



The user interface layout is created with CuCanvas.



```
#include "CT18XX"

Dim TX1 As Integer
Dim TY1 As Integer
Dim Va As Integer
Basic_FORM1

On Pad Gosub TouchOccur
'
' ********************* Main Loop ************************
'
Do
      Locate 2,5
      Print "20",Hp(Rtcread(6),2,1),"   ", Hp(Rtcread(5),2,1),"    ",
Hp(Rtcread(4),2,1)
      Locate 23,5
      Print Hp(Rtcread(2),2,1),"    ", Hp(Rtcread(1),2,1),"    ", Hp(Rtcread(0),2,1)
      Wait 1000
Loop

TouchOccur:
      TX1 = Sys(10)
      TY1 = Sys(11)
      If Menucheck(0,TX1,TY1) = 1 Then          ' Year
            EffectFlash 0
            VaIncr 6,99
      Elseif Menucheck(1,TX1,TY1) = 1 Then
            EffectFlash 1
            VaDecr 6,0
      Endif
      If Menucheck(2,TX1,TY1) = 1 Then          ' Month
            EffectFlash 2
            VaIncr 5,12
      Elseif Menucheck(3,TX1,TY1) = 1 Then
            EffectFlash 3
            VaDecr 5,1
      Endif
      If Menucheck(4,TX1,TY1) = 1 Then          ' Date
            EffectFlash 4
            VaIncr 4,31
      Elseif Menucheck(5,TX1,TY1) = 1 Then
            EffectFlash 5
            VaDecr 4,1
      Endif
      If Menucheck(6,TX1,TY1) = 1 Then          ' Hour
            EffectFlash 6
            VaIncr 2,23
      Elseif Menucheck(7,TX1,TY1) = 1 Then
            EffectFlash 7
            VaDecr 2,0
      Endif
      If Menucheck(8,TX1,TY1) = 1 Then          ' Min
            EffectFlash 8
            VaIncr 1,59
      Elseif Menucheck(9,TX1,TY1) = 1 Then
            EffectFlash 9
            VaDecr 1,0
      Endif
      If Menucheck(10,TX1,TY1) = 1 Then         ' Sec
            EffectFlash 10
            VaIncr 0,59
```

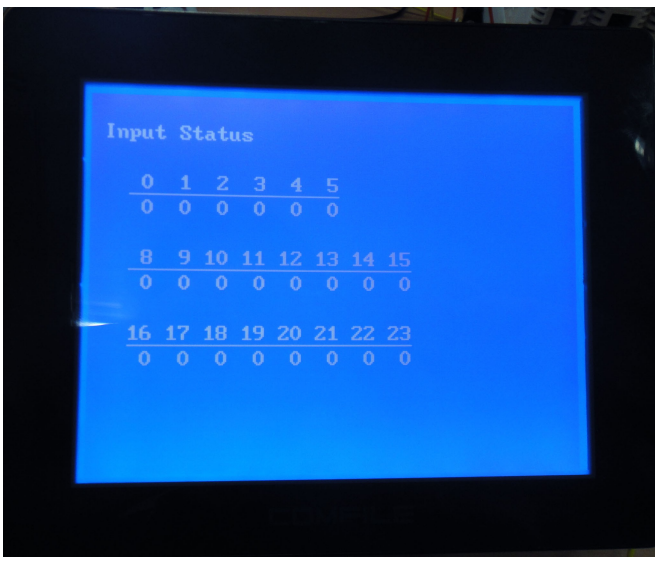
```
      Elseif Menucheck(11,TX1,TY1) = 1 Then
             EffectFlash 11
             VaDecr 0,0
      Endif
      Return




End

Sub EffectFlash (IxM As Integer)
      Menureverse IxM
      Ct18beep 20
      Wait 200
      Menureverse IxM
End Sub

Sub VaIncr(AddrRTC As Integer, LimitThis As Integer)
      Dim Tm As Byte
      Dim Dtm As Byte
      Tm = Rtcread(AddrRTC)
      Dtm = Bcd2bin(Tm)
      Incr Dtm
      If Dtm > LimitThis Then Decr Dtm
      Tm = Bin2bcd(Dtm)
      Rtcwrite AddrRTC,Tm
End Sub

Sub VaDecr(AddrRTC As Integer, Limitunder As Integer)
      Dim Tm As Byte
      Dim Dtm As Byte
      Tm = Rtcread(AddrRTC)
      Dtm = Bcd2bin(Tm)
      If Dtm > Limitunder Then Decr Dtm
      Tm = Bin2bcd(Dtm)
      Rtcwrite AddrRTC,Tm
End Sub


Sub Basic_FORM1()
      Font 2,0
      Style 0,0,0
      Menuset 0,2,15,40,45,60
      Menutitle 0,11,2,"+"
      Menuset 1,2,15,125,45,145
      Menutitle 1,11,2,"-"
      Menuset 2,2,65,40,95,60
      Menutitle 2,11,2,"+"
      Font 0,0
      Menuset 3,2,65,125,95,145
      Menutitle 3,11,2,"-"
      Font 3,0
      Menuset 4,2,115,40,145,60
      Menutitle 4,11,2,"+"
      Menuset 5,2,115,125,145,145
      Menutitle 5,11,2,"-"
      Menuset 6,2,175,40,205,60
      Menutitle 6,11,2,"+"
      Menuset 7,2,175,125,205,145
      Menutitle 7,11,2,"-"
      Menuset 8,2,225,40,255,60
```

```
      Menutitle 8,11,2,"+"
      Menuset 9,2,225,125,255,145
      Menutitle 9,11,2,"-"
      Font 2,0
      Menuset 10,2,275,40,305,60
      Menutitle 10,11,2,"+"
      Font 3,0
      Menuset 11,2,275,125,305,145
      Menutitle 11,11,2,"-"
      Linestyle 0
      Dotsize 0,0
      Color 1
      Box 5,20,155,165
      Box 165,20,315,165
      Font 0,1
      Glocate 15,175
      Gprint "Year   Month  Date "
      Glocate 175,175
      Gprint "Hour    Min    Sec"
      Font 6,1
      Glocate 90,195
      Gprint "RTC Setting"
      Font 4,0

End Sub
```

Sample 9: Input Status Monitor

This program displays the state of each digital input.

```
#include "CT18XX"
Style 0,0,0
Locate 1,1
Print "Input Status"
Style 0,0,1
Locate 3,3
Print " 0  1  2  3  4  5"
Locate 3,6
Print " 8  9 10 11 12 13 14 15"
Locate 3,9
Print "16 17 18 19 20 21 22 23"
Style 0,0,0
Do
Locate 2,4
Print hex3 In(0),hex3 In(1),hex3 In(2),hex3 In(3),hex3 In(4),hex3 In(5)
Locate 2,7
Print hex3 In(8),hex3 In(9),hex3 In(10),hex3 In(11)
Print hex3 In(12),hex3 In(13),hex3 In(14),hex3 In(15)
Locate 2,10
Print hex3 In(16),hex3 In(17),hex3 In(18),hex3 In(19)
Print hex3 In(20),hex3 In(21),hex3 In(22),hex3 In(23)
Wait 500

Loop
```



Sample 10: Digital Output Control

This program can be used to control the state of each digital output.

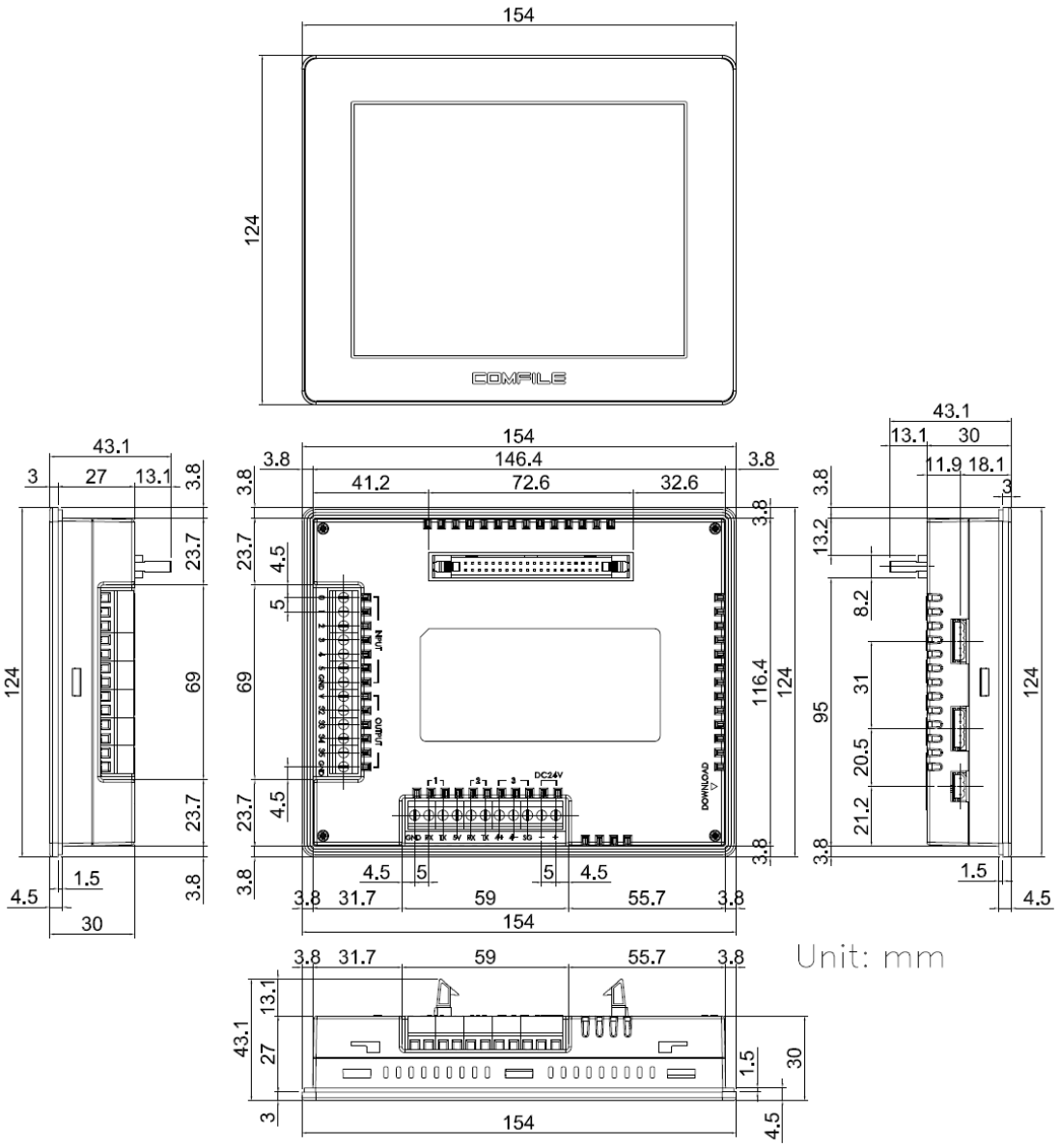
```
#include "CT18XX"

Dim TX1 As Integer
Dim TY1 As Integer
Dim Ixx As Integer
Basic_FORM1

Byteout 4,0
Byteout 5,0
Byteout 6,0
On Pad Gosub TouchOccur
Do
Loop

TouchOccur:
      TX1 = Sys(10)
      TY1 = Sys(11)
      Ct18beep 10

      If Menucheck(0,TX1,TY1) = 1 Then
             Menureverse2 0,1
             Reverse 32
      Elseif Menucheck(1,TX1,TY1) = 1 Then
             Menureverse2 1,1
             Reverse 33
      Elseif Menucheck(2,TX1,TY1) = 1 Then
             Menureverse2 2,1
             Reverse 34
      Elseif Menucheck(3,TX1,TY1) = 1 Then
             Menureverse2 3,1
             Reverse 35

      Elseif Menucheck(4,TX1,TY1) = 1 Then
             Menureverse2 4,1
             Reverse 40
      Elseif Menucheck(5,TX1,TY1) = 1 Then
             Menureverse2 5,1
             Reverse 41
      Elseif Menucheck(6,TX1,TY1) = 1 Then
             Menureverse2 6,1
             Reverse 42
      Elseif Menucheck(7,TX1,TY1) = 1 Then
             Menureverse2 7,1
             Reverse 43
      Elseif Menucheck(8,TX1,TY1) = 1 Then
             Menureverse2 8,1
             Reverse 44
      Elseif Menucheck(9,TX1,TY1) = 1 Then
             Menureverse2 9,1
             Reverse 45
      Elseif Menucheck(10,TX1,TY1) = 1 Then
             Menureverse2 10,1
             Reverse 46
      Elseif Menucheck(11,TX1,TY1) = 1 Then
             Menureverse2 11,1
```

```
              Reverse 47

      Elseif Menucheck(12,TX1,TY1) = 1 Then
              Menureverse2 12,1
              Reverse 48
      Elseif Menucheck(13,TX1,TY1) = 1 Then
              Menureverse2 13,1
              Reverse 49
      Elseif Menucheck(14,TX1,TY1) = 1 Then
              Menureverse2 14,1
              Reverse 50
      Elseif Menucheck(15,TX1,TY1) = 1 Then
              Menureverse2 15,1
              Reverse 51
      Elseif Menucheck(16,TX1,TY1) = 1 Then
              Menureverse2 16,1
              Reverse 52
      Elseif Menucheck(17,TX1,TY1) = 1 Then
              Menureverse2 17,1
              Reverse 53
      Elseif Menucheck(18,TX1,TY1) = 1 Then
              Menureverse2 18,1
              Reverse 54
      Elseif Menucheck(19,TX1,TY1) = 1 Then
              Menureverse2 19,1
              Reverse 55
      Endif
      Return

End

Sub Basic_FORM1()
      Font 0,0
      Style 0,0,0
      Menuset2 0,1,70,80,105,100
      Menutitle 0,10,4,"32"
      Menuset2 1,1,110,80,145,100
      Menutitle 1,10,4,"33"
      Menuset2 2,1,150,80,185,100
      Menutitle 2,10,4,"34"
      Menuset2 3,1,190,80,225,100
      Menutitle 3,10,4,"35"
      Menuset2 4,1,5,115,40,135
      Menutitle 4,10,4,"40"
      Menuset2 5,1,45,115,80,135
      Menutitle 5,10,4,"41"
      Menuset2 6,1,85,115,120,135
      Menutitle 6,10,4,"42"
      Menuset2 7,1,125,115,160,135
      Menutitle 7,10,4,"43"
      Menuset2 8,1,165,115,200,135
      Menutitle 8,10,4,"44"
      Menuset2 9,1,205,115,240,135
      Menutitle 9,10,4,"45"
      Menuset2 10,1,245,115,280,135
      Menutitle 10,10,4,"46"
      Menuset2 11,1,285,115,319,135
      Menutitle 11,9,4,"47"
      Menuset2 12,1,5,150,40,170
      Menutitle 12,10,4,"48"
      Menuset2 13,1,45,150,80,170
      Menutitle 13,10,4,"49"
```

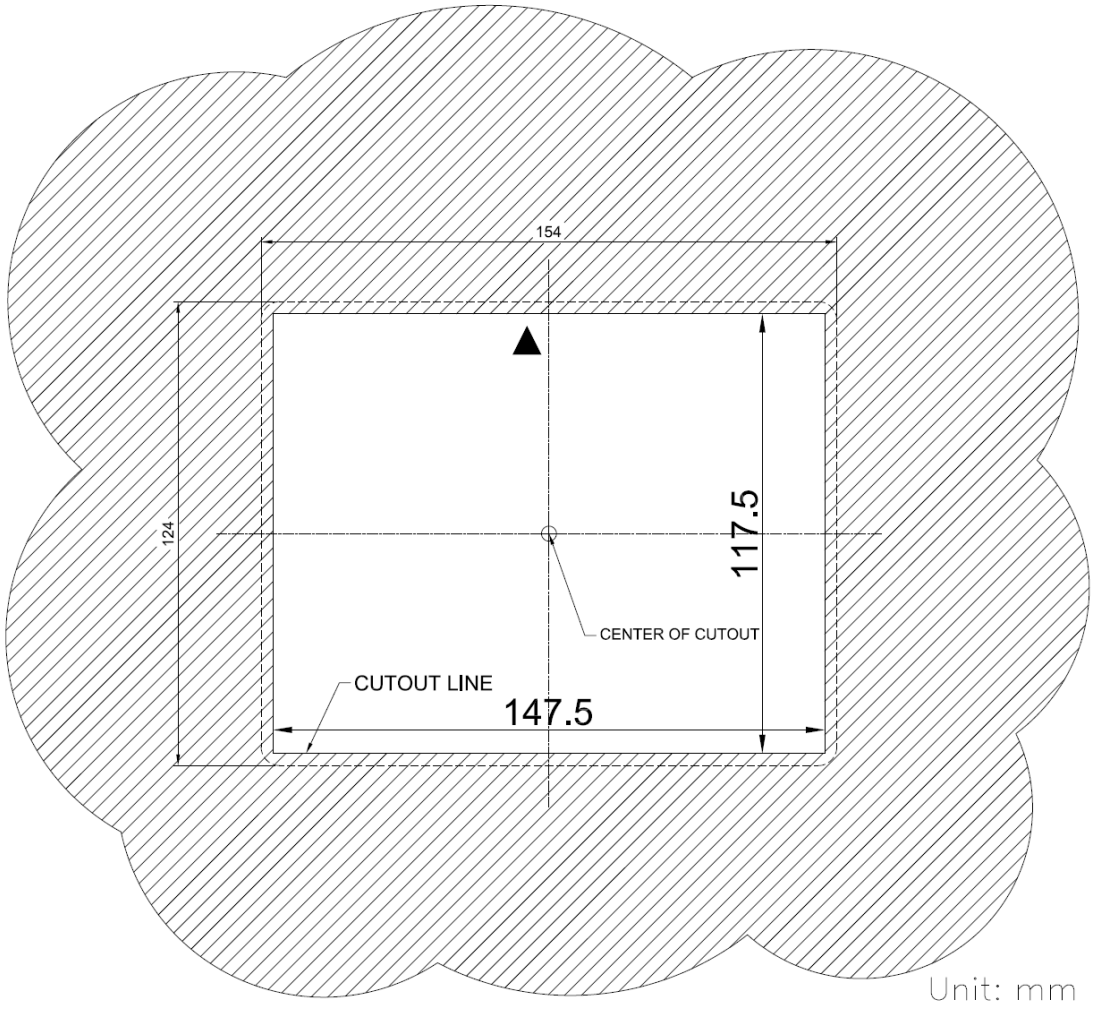
```
      Menuset2 14,1,85,150,120,170
      Menutitle 14,10,4,"50"
      Menuset2 15,1,125,150,160,170
      Menutitle 15,10,4,"51"
      Menuset2 16,1,165,150,200,170
      Menutitle 16,10,4,"52"
      Menuset2 17,1,205,150,240,170
      Menutitle 17,10,4,"53"
      Menuset2 18,1,245,150,280,170
      Menutitle 18,10,4,"54"
      Menuset2 19,1,285,150,319,170
      Menutitle 19,9,4,"55"
      Font 6,1
      Glocate 50,25
      Gprint "OUT PORT CHECK"
      Font 4,0
End Sub
```

Chapter 7
Panel Mounting

Dimensions


154
124
COMFILE
43.1
3
27
13.1
3.8
23.7
69
23.7
1.5
4.5
30
124
154
146.4
41.2
72.6
32.6
4.5
5
116.4
31.7
59
55.7
DC24V
DOWNLOAD
43.1
13.1
30
11.9
18.1
13.2
8.2
31
20.5
21.2
95
1.5
4.5
Unit: mm

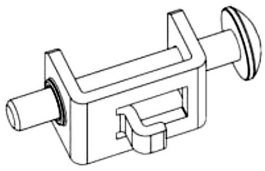
Panel Cutout



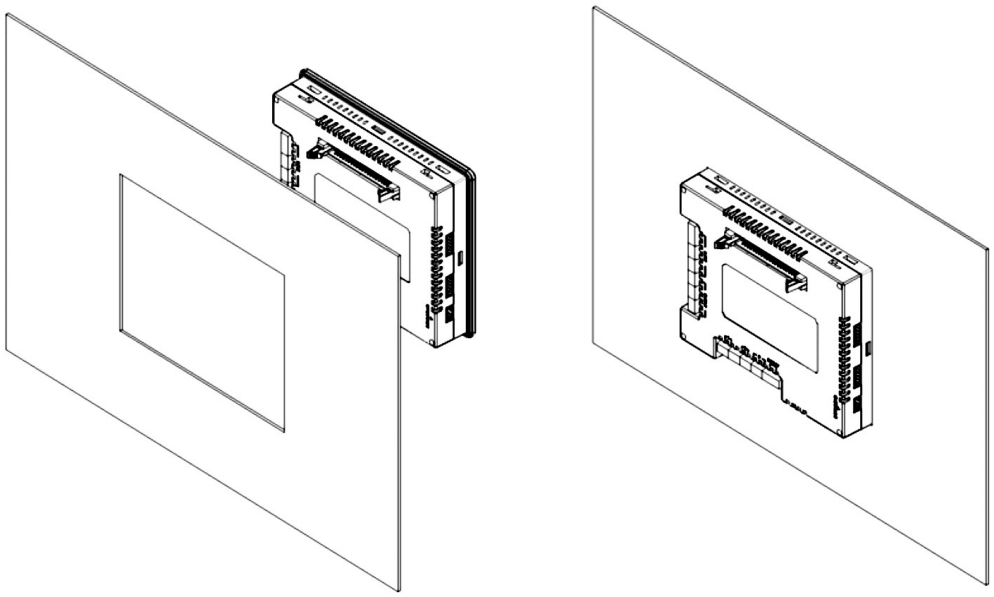
Panel Mounting Procedure

Panel mounting brackets and matching bolts are included with each purchase (upper/lower 2ea.)

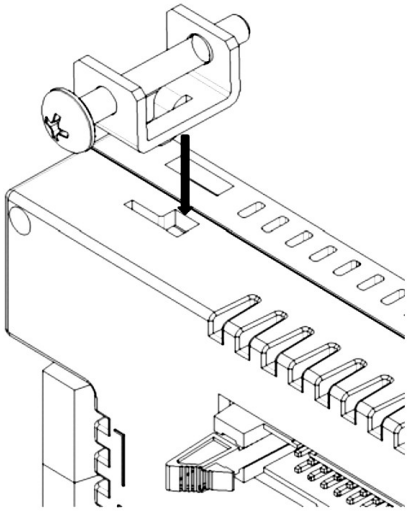
(Preparation: Insert the bolt into the mounting bracket as shown in the image below

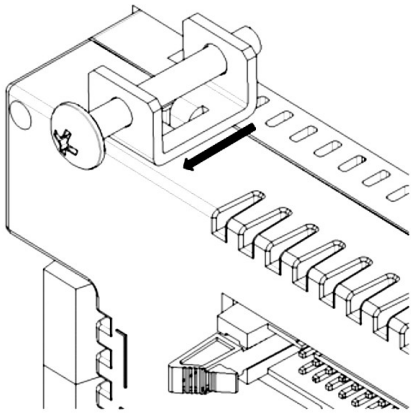


1. Insert the unit into a properly prepared panel cutout per the previously described panel cutout dimensions. (Panel thickness can be between 1 and 6 mm.)

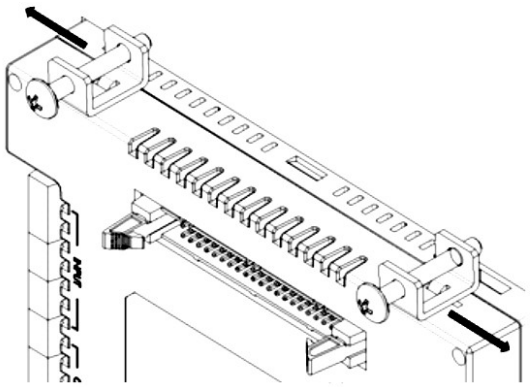


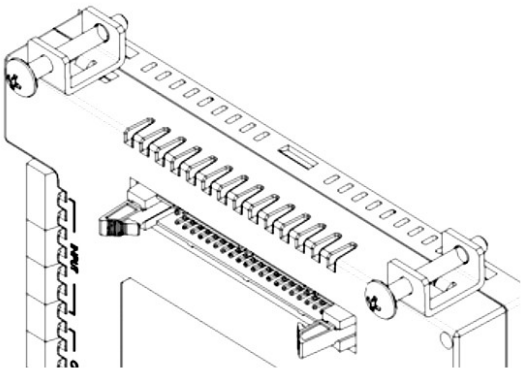
2. Insert the mounting brackets into the groove on the side of the unit, pull the bracket towards the rear of the unit.





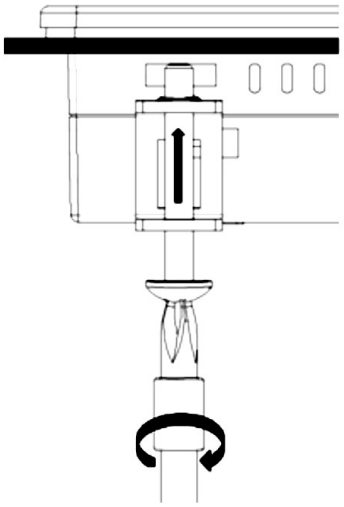
3. Slide the bracket laterally to secure in place.

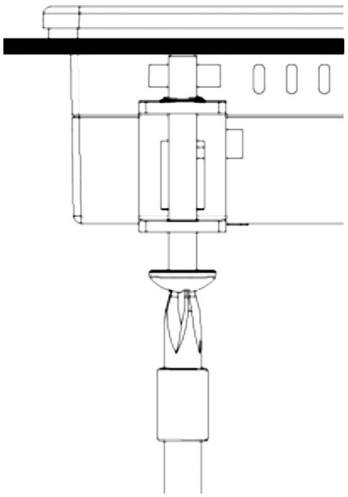




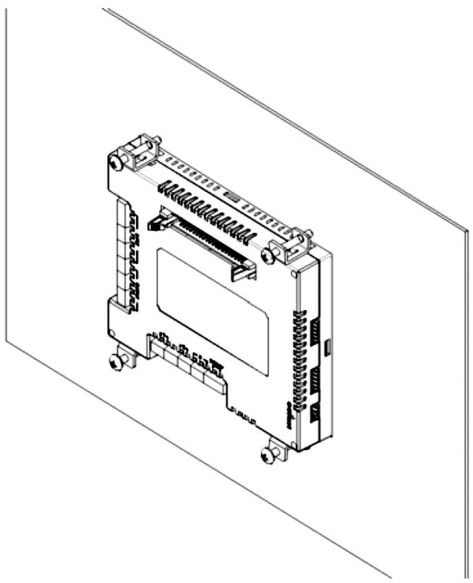
4. Tighten the bolts to secure the unit to the panel.

   (Caution: Be careful not to tighten the bolts excessively to avoid damaging to the unit and/or the panel)





5. Repeat steps 2~4 for each remaining mounting bracket.



- A look at the CT1820 after properly mounted –